A Risk-based Audit of the Captive/Privately-owned Cervid Industry in Michigan

Michigan Department of Natural Resources Report Series
Issue Report No. 1
March 10, 2005

Data Analysis and Final Report Committee
Michigan Department of Natural Resources

D. O'Brien, Wildlife Division (Chair)
P. Bernardi, Law Enforcement Division
S. Dubay, Wildlife Division
S. Mayhew, Wildlife Division
W. Moritz, Wildlife Division
D. Purol, Law Enforcement Division

Executive Summary

Deer and closely related species such as elk (*Cervus elaphus nelsoni*), moose (*Alces alces*), and caribou (*Rangifer tarandus*), scientifically classified as members of the Family *Cervidae* are collectively referred to as "Cervids." While the general public commonly considers cervids wildlife, cervids raised in enclosures and cared for by humans (variously called "captive," "privately-owned,"[1] or "farmed") form a group distinct from free-ranging (i.e., "wild") cervids. Management of these captive/privately-owned cervids (C/P-OC) presents a number of unique challenges and opportunities. Because C/P-OC management involves aspects relevant to both agriculture and resource conservation, both the Michigan Departments of Agriculture (MDA) and Natural Resources (MDNR) have responsibilities in C/P-OC regulation. Both agencies recognize the potential of diseases, specifically Chronic Wasting Disease and Bovine Tuberculosis, to negatively impact both privately owned livestock and wildlife in Michigan.

The term "Captive/Privately Owned Cervid Industry" refers to the collective body of enclosures. This industry is composed of 740 facilities located throughout the State, ranging in size from less than 1 acre to over 5,000 acres. Facilities are classified into 4 categories based on function: Hobby, Exhibition, Ranch, and Full Registration. While Hobby and Exhibition are self explanatory, Ranches provide shooting opportunities, and Full Registration facilities provide breeding stock, shooting stock, and sale of live animals for hobby and exhibition operations.

As a result of recommendations from the Michigan CWD Task Force and an Executive Order of the Governor, a risk-based audit of the state's C/P-OC industry was carried out "not to be punitive, but to find any flaws or weaknesses in the current system that might lead to the entrance of CWD into Michigan's captive and wild cervid herds." With the cooperation of the MDA's Animal Industry Division and C/P-OC producers around the state, the Law Enforcement and Wildlife Divisions of the MDNR audited 584 C/P-OC facilities throughout the state between June 15, 2004 and October 26, 2004, of which 506 were active operations. Auditors collected data on a variety of factors related to the risk of introduction and spread of CWD in the state, including number and types of cervids held, the places from which they were obtained, how they were identified, the types, heights and conditions of fences, and information about CWD testing and escapes.

During the period of the audit, audited facilities housed a total of 32,493 C/P-OC based on facility owner information. More than 30,000 (30,616 or 94.2%) of those animals were of species known or anticipated to be susceptible to CWD. The vast majority (25,976 or 84.8%) were white-tailed deer. Elk were second most abundant at 4,029 animals (13.2%), and 611 animals (2.0%) were red deer (*Cervus elaphus elaphus*). Full Registration facilities housed 13,840 (42.6%) C/P-OC while Ranches housed 18,394 (56.6%).

Overall, auditors determined that 37% of all C/P-OC facilities were not in compliance with current regulations at the time of the audit. The principal areas of deficiency related to the identification of animals, the rate of CWD testing, conditions of fences, and the rate and reporting of escaped animals.

In spite of the unique characteristics of CWD as a disease, many of the risks for its introduction and propagation identified during the course of this audit are recurring themes in the surveillance and control of other contagious diseases in other species. While many issues of note, both positive and negative, were found in these inspections of Michigan C/P-OC facilities, the following stand out as deserving comments and recommendations:

- Efforts to minimize the risks of introduction and propagation of CWD via C/P-OC in Michigan begin and end with individual animal identification. The current animal identification regulations are inadequate because they do not require facility owners to identify all C/P-OC or to identify them all in

[1] The terms used to refer to these animals differ between stakeholder groups. In Michigan, agricultural groups prefer the term "privately-owned cervids," whereas natural resource groups more commonly recognize the term "captive cervids." To avoid confusion of either group, for the purposes of this report they are referred to collectively as "captive/privately-owned cervids" (abbreviated C/P-OC).

a unique and uniform way. A system must be implemented that is mandatory, uniform across all facilities and classes, and that provides unique and visible identification to each individual by which the animal can be traced throughout its lifetime. All animals must be identified by 1 year of age, and the appropriate state agency must issue and administer the identification system. The identification must also be easily visible so that each and every animal is clearly identified as a C/P-OC in the event of escape. In calling for this requirement, we understand that identification of every animal may be very difficult for Ranch facilities because of their size and their inherently less intensive management and handling of the animals. Nonetheless, individual animal identification is so critical to minimizing and managing disease risk that facilities such as Ranches that cannot reliably and verifiably identify each and every individual should be subject to more stringent and vigorously enforced fencing and biosecurity regulations to ensure that unmarked animals do not leave the facility alive under any circumstances.

- Along with animal identification, CWD testing of Michigan C/P-OC, or more accurately, the lack of testing, was the greatest risk for introduction and propagation of the disease identified during this audit. In spite of a mandatory testing program for all C/P-OC over 16 months of age that die plus a representative percentage of culls, nearly 90% of the reported C/P-OC deaths were not tested for CWD. While some facilities have tested in good faith, nearly half of the audited Ranch and Full Registration facilities reported that they had submitted no CWD tests at all. Without adequate CWD testing, the introduction of CWD into the State's C/P-OC cannot be detected. More ominously, this same lack of testing means that we cannot rule out the possibility the disease is already here and currently propagating undetected. Steps have been taken jointly by MDA and MDNR to notify producers of testing requirements and provide information about sample submission (letter dated Nov 15, 2004).

- The lack of a specified protocol for de-commissioning or de-registering a C/P-OC facility is a risk for introduction and propagation of CWD. Audit teams found a number of facilities that wanted to leave the C/P-OC business but had little guidance from regulations on how to decommission. As a result, understandably frustrated facility owners may deal with the situation in a way they deem appropriate, which, at worst, could mean releasing their C/P-OC into the free-ranging cervid population. Appropriate regulations should be developed speedily, and those regulations should provide for an outreach/education program to inform and assist C/P-OC producers who wish to leave the business and get rid of their animals.

- Procedures to deal with facility abandonment, are conspicuously absent and critically needed. As an example, when inspectors visited a facility during the audit, fences were down, the C/P-OC were gone, and the owner had moved out of state. In such cases, given the currently inadequate regulatory provisions for individual animal identification and recordkeeping, there is no way to be sure what happened to the animals or verify the CWD risk those animals, or the land once used as a C/P-OC facility, pose to the free-ranging cervid population. Penalties for cases where an owner just "walks away" from a facility should be sufficiently severe to provide a strong deterrent for this unacceptable behavior.

- Another area of risk for CWD introduction and propagation for which both C/P-OC facilities and regulating state agencies bear some burden of responsibility is that of inadequate recordkeeping. To the credit of the C/P-OC industry, the vast majority of inspected facilities not only keep records, but the records they keep were judged to be in compliance with current regulations. However, the current regulations are not particularly stringent when viewed in the context of what is required of a recordkeeping system in order to minimize disease risks. For example, most of the records kept are on paper, and while they comply with current regulations, lack of simultaneous accessibility of these

records by the multiple parties necessary to ensure adequate disease surveillance presents an obvious risk. In addition to the issues discussed relative to animal identification, the State needs to reevaluate and improve the way it gathers and stores regulatory information from C/P-OC facilities so that the information is rapidly, efficiently, and widely accessible to multiple agencies and producers, and so that important data linkages are maintained. The development of an electronic data collection, archiving, and reporting system to aid compliance, enforcement, and disease risk assessment should be a high priority. Such a system is currently lacking, and its design, development, and implementation should involve both information technology and disease control specialists to ensure an adequate system is developed.

- These audit findings also revealed the risk of C/P-OC escapes. In spite of the fact that reporting of "releases" is mandatory in current regulations, it is clear not only that escapes occur but that they are rarely reported. Of 464 escapes reported to audit inspectors, only 8 releases were apparently reported to MDA. Twenty percent of Class IV and about 14% of Class III C/P-OC facilities experienced escapes, which is likely to be an underestimate. Adding to the risk is the fact that only half of the escaped C/P-OC from Ranches bore identification. Most escaped C/P-OC were reported to have been recovered, yet the time allowed for reporting and recovery under current regulations is sufficient to add substantial risk of CWD introduction even for recovered animals. The development of more stringent escape and recovery protocols, along with enforcement and stiffening of penalties for non-reporting, is critical. Consideration should be given to measures which would allow agencies to dictate the rapidity and conduct of recovery operations based on risk and automatically make unreported escaped C/P-OC public property and subject to immediate harvest. These protocols should include measures to explicitly provide authority to agencies to manage the harvest of non-native cervid species. The Natural Resources Commission approved regulations to allow harvest of escaped exotic Cervids in January 2005. The documentation by this audit of another practice, the intentional release of C/P-OC into the wild, is also both notable and deeply troubling.

- Uniform regulatory requirements for the composition and maintenance of perimeter fencing should be developed and enforced. Current regulations specify that fences be constructed only of woven wire, yet in practice, C/P-OC facilities use a variety of other materials that agencies consider to be in compliance with the standards. Some of these materials very likely are adequate. Updated regulations should include specific guidance such as (but not limited to) minimum gauge of wire, mesh size, and distance between posts. In addition, the revised regulations need to address the current problematic conflict in fencing standards, which both specify minimum fence heights by species, yet also specify that fences need to prevent the ingress and egress of any cervid species. We cannot overstate the crucial role of fences in minimizing the risks of CWD introduction and propagation. In spite of their similar appearances, C/P-OC and free-ranging cervids are separate populations from the standpoint of disease control, and the separation between those populations should be maintained at all times. Good fences not only protect free-ranging cervids from C/P-OC, but vice versa.

- Some summary mention of Ranch facilities is warranted because of their unique characteristics and the unique risks they hold for CWD introduction and propagation. This audit found that of the 4 facility classes, Ranches enclosed the largest number of CWD-susceptible C/P-OC (>18,000 statewide), imported the largest numbers of C/P-OC from out-of-state sources (including from CWD-positive states), had the largest percentage of animals lacking individual identification, had the lowest rate of CWD testing, and had the lowest rates of recovery and identification of escapees. In addition, Ranch facilities are located in areas with some of the highest free-ranging WTD densities in the state. If CWD were to infect C/P-OC that subsequently escape from one of these facilities, propagation of CWD in the surrounding free-ranging population would likely be rapid. We do not intend these remarks to stigmatize all Ranch facilities. Some of the best managed C/P-OC facilities in the state are Ranches. However, because of this combination of factors that increase CWD risks, serious

consideration should be given to making registration and fencing requirements for Ranches more stringent than those for other classes of C/P-OC facilities. This may help provide greater assurance that registered facilities will be well managed and economically self-sufficient, and capable of providing needed disease surveillance and management safeguards.

- An emerging issue with respect to the risks of CWD introduction and propagation is potential environmental contamination via the manure or carcasses of infected animals. This audit was able to gather some of the first information on the ways that C/P-OC facilities manage and dispose of these materials. This is an area where development of workable regulations should be an ongoing priority for both agriculture and natural resource agencies. While the attention paid to issues of carcass and manure management and disposal is likely to increase in the future because of recent research findings, agencies and the industry must also keep the place of these items in proper perspective within the context of the overall risks of CWD transmission. The available research and the current scientific opinions of preeminent CWD scientists agree that the highest risks for introduction and propagation of the disease are the movements of, and contact between, live animals. The role played by carcasses and manure from infected animals, while by no means negligible, is a distant second in terms of risk importance, with contamination of machinery and equipment an even more distant third. It is critical that disease control experts and policy makers keep this relative risk ranking in mind so that attention, as well as limited time and resources, are not diverted from the most important sources of CWD risk.

- Measures of the overall non-compliance of C/P-OC facilities (37% of C/P-OC facilities judged non-compliant by audit inspectors) essentially speak for themselves. While the validity and meaning of these measures can be debated, clearly an appreciable amount of non-compliance exists among C/P-OC facilities, and there is substantial room for improvement.

In many respects, identifying the need for improvements in the C/P-OC industry to minimize the risks of introduction and propagation of CWD, and even suggesting remedies, is the easy part of the process. Much more difficult is the task of finding and applying sufficient resources to make the remedies happen. Agencies and policy makers should harbor no illusions about the amount of funding, personnel, and time needed to ensure the implementation and enforcement of the measures suggested in this report. All will be sizeable, but such support will be necessary if Michigan is serious about minimizing disease risks. It is only fair to point out that many of the problems identified with respect to current C/P-OC regulations and their implementation may have been largely due to a failure to provide the money and expertise necessary to do the job properly. In the end, measures taken to prevent the introduction and spread of CWD to Michigan will benefit both free-ranging cervids and C/P-OC, and the methods devised to fund risk mitigation measures should reflect that fact.

Acknowledgments

The authors want to acknowledge that even though our names appear on this Final Report, others completed the vast majority of the work of this audit. They deserve a great deal of credit for their efforts, efforts made over and above work schedules that for most were already strained. Primary credit lies with the teams of Conservation Officers and Wildlife Biologists who conducted the audit inspections and with D. Dominic and D. Purol who organized, scheduled, and managed the logistical challenges of hundreds of inspections. Credit is also due to T. Pullen who helped in the organization of photographic data, to J. Kennedy and T. Riebow who spent many hours entering questionnaire data by hand, and to K. Gardiner, Y. Li, T. Oliver and M. Strong who provided mapping expertise. The members of the various audit planning and training committees are too numerous to name here, but their efforts to plan and organize the audit from scratch in less than a month's time were indispensable and nothing short of amazing. Thanks are also due to the Animal Industry Division of the Michigan Department of Agriculture for providing full cooperation and access to their data and records. Finally, credit and thanks are extended to the captive/privately-owned cervid facilities of Michigan and their producer groups, whose cooperation under difficult circumstances allowed this audit to be completed.

Preface

In writing this Report, we had three primary goals: 1) to provide the best context we could for the potential disease risks (or lack of them) associated with the audit's findings; 2) to comprehensively and accurately document the findings of the audit inspections in the interest of transparency; and 3) to meticulously document the environment, planning, and conduct of the audit, hopefully to provide some guidance and assistance to other groups or agencies faced with a similar task in the future.

The Report is long, but this was the unavoidable consequence of our effort to be comprehensive. All audit data that could be summarized and presented in a reasonably concise way are included here, either in the Results themselves or in Appendices. The Report was not written with the intent that everyone would read it cover to cover. Rather, it is organized into sections which were intended to stand on their own. As a result, some issues are covered repeatedly. Of necessity, some topics overlap. The Table of Contents is organized so that a reader with a specific interest in a particular risk topic can locate that topic easily and view a summary of the audit findings relevant to it without having to read the entire report.

Table of Contents

List of abbreviations

AB	Alberta, Canada
AHDL	Animal Health Diagnostic Laboratory
AIA	Animal Industry Act
AID	Animal Industry Division, Michigan Department of Agriculture
APHIS-VS	Animal and Plant Health Inspection Service, Veterinary Services
APHIS-WS	Animal and Plant Health Inspection Service, Wildlife Services
BODA	Bodies of Dead Animals Act
BSE	Bovine spongiform encephalopathy
CA	California, U. S.
CO	Colorado, U. S.
C/P-OC	Captive/privately owned cervid(s)
CWD	Chronic wasting disease
DCDS	Data Collection and Distribution System
DCPAH	Diagnostic Center for Population and Animal Health
ELISA	Enzyme-linked immunosorbent assay
EUP MU	Eastern upper peninsula management unit
GIS	Geographic information system
GPS	Global positioning system
IA	Iowa, U. S.
ID	Identification
IHC	Immunohistochemistry
IL	Illinois, U. S.
KS	Kansas, U. S.
KY	Kentucky, U. S.

LED	Law Enforcement Division, MDNR
MAIN	Michigan Administrative Information Network
MI	Michigan, U. S.
MDA	Michigan Department of Agriculture
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MN	Minnesota, U. S.
MSU	Michigan State University
MT	Montana, U. S.
MU	Management unit
ND	North Dakota, U. S.
NE	Nebraska, U. S.
NE MU	Northeastern lower peninsula management unit
NH	New Hampshire, U. S.
NM	New Mexico, U. S.
NREPA	Natural Resources and Environmental Protection Act
NVSL	National Veterinary Services Laboratory
NW MU	Northwestern lower peninsula management unit
NY	New York, U. S.
OK	Oklahoma, U. S.
OR	Oregon, U. S.
OSRPOCF	Operational Standards for Registered Privately Owned Cervidae Facilities
PA	Pennsylvania, U. S.
P.A.	Public Act
POCPMA	Privately Owned Cervidae Producers Marketing Act
RI	Rhode Island, U. S.

SB MU	Saginaw Bay management unit
SC	South Carolina, U. S.
SC MU	South-central lower peninsula management unit
SD	South Dakota, U. S.
SE MU	Southeastern lower peninsula management unit
SW MU	Southwestern lower peninsula management unit
SK	Saskatchewan, Canada
TB	Bovine tuberculosis (*Mycobacterium bovis*)
TSE	Transmissible spongiform encephalopathy
USAID	United States National Animal Identification Development
USDA	United States Department of Agriculture
UT	Utah, U. S.
VIC	Veterinary inspection certificate
VT	Vermont, U. S.
WA	Washington, U. S.
WDL	Wildlife Disease Laboratory
WI	Wisconsin, U. S.
WLD	Wildlife Division, MDNR
WTD	White-tailed deer
WUP MU	Western upper peninsula management unit
WY	Wyoming, U. S.

1. Background and history

1.1 The captive/privately-owned cervid industry in Michigan

1.1.1 *Basis and history of regulatory authorities.* Deer and closely related species such as elk (*Cervus elaphus nelsoni*), moose (*Alces alces*), and caribou (*Rangifer tarandus*), scientifically classified as members of the Family *Cervidae*, are collectively referred to as "Cervids." While the general public commonly considers cervids wildlife, cervids raised in enclosures and cared for by humans (variously called "captive," "privately-owned,"[2] or "farmed") form a group distinct from free-ranging (i.e., "wild") cervids. Management of these captive/privately-owned cervids (C/P-OC) presents a number of unique challenges and opportunities (Coon et al. 2000). Because C/P-OC management involves aspects relevant to both agriculture and resource conservation, both the Michigan Departments of Agriculture (MDA) and Natural Resources (MDNR) have played roles in C/P-OC regulation.

The legislature granted regulatory authority to issue licenses for individuals to hold free-ranging wildlife (which belong to all the citizens of the State) in captivity to the Department of Conservation, predecessor to MDNR, in Public Act (P.A.) 191 of 1929. Later incorporated into the Natural Resources and Environmental Protection Act (NREPA), P.A. 451 of 1994 (NREPA 1994a), these regulations covered matters such as construction of enclosures, take of free-ranging wildlife, removal of animals, and escapes, among others. MDNR also holds responsibility and authority to protect and conserve free-ranging wildlife in trust for the public (NREPA 1994b).

MDA, specifically the State Veterinarian, was granted regulatory authority over the health and welfare of domestic animals in the Animal Industry Act (AIA), P.A. 466 of 1988 (AIA 1988). The AIA was "intended to protect the health, safety, and welfare of humans and animals" and consequently addresses primarily health and disease issues for animals that live under the husbandry of humans. In response to requests from C/P-OC owners/producers and following extensive discussions among MDA, the Michigan Department of Environmental Quality (MDEQ), MDNR, and producer groups, the Privately Owned Cervidae Producers Marketing Act (POCPMA), P.A. 190 of 2000 (POCPMA 2000) transferred principal regulatory authority over C/P-OC to MDA. Effective June 1, 2001, POCPMA was intended "to define, develop, and regulate privately owned cervidae as an agricultural enterprise," drawing a clearer legal distinction between C/P-OC and free-ranging cervids. The act formally defined C/P-OC as livestock, authorized MDA to "develop and assist the cervidae industry," and characterized the roles of MDNR and MDEQ in the management of C/P-OC. MDNR retained the authority to inspect facilities prior to MDA registration to ensure that enclosures did not unreasonably stress the habitat and migration routes of free-ranging wildlife and that all free-ranging cervids had been removed. The Michigan Commission of Agriculture adopted the Operational Standards for Registered Privately Owned Cervidae Facilities (OSRPOCF 2000) in May 2000.

1.1.2 *Expansion of the industry in Michigan*. While descriptive data are limited, MDNR records of permits issued to hold wildlife in captivity provide a coarse measure of the growth of the C/P-OC industry over the last 2 decades. In 1984 there were 109 game breeder licenses recorded for white-tailed deer (*Odocoileus virginianus*; WTD) and 7 for elk in the state of Michigan. In that same year, possession licenses (roughly representing hobby and pet animals) numbered 31 for WTD and 0 for elk (J. Janson, MDNR Wildlife Division, personal communication 10/21/04). Between 1994 and 1998, the number of C/P-O deer grew by 50% with animal numbers reaching approximately 21,000 statewide (Coon et al. 2000). Similarly, C/P-O elk doubled over the same

[2] The terms used to refer to these animals differ between stakeholder groups. In Michigan, agricultural groups prefer the term "privately-owned cervids," whereas natural resource groups more commonly recognize the term "captive cervids." To avoid confusion of either group, for the purposes of this report they are referred to collectively as "captive/privately-owned cervids" (abbreviated C/P-OC).

period, with annualized growth of nearly 19% and animal numbers reaching approximately 2,600 by 1998. Michigan trends were similar to national trends over the same period (Coon et al. 2000).

1.2 Chronic Wasting Disease

1.2.1 *Biology.* Chronic Wasting Disease (CWD) is a naturally-occurring prion disease of native North American WTD, mule and black-tailed deer (*Odocoileus hemionus*), and elk (Williams and Miller 2002; Williams et al. 2002). Only these 3 species are currently documented to be naturally susceptible to the disease. CWD is a distinct member of a family of slowly progressive nervous system diseases known as transmissible spongiform encephalopathies (TSEs). Although scientific debate continues, the vast majority of available evidence suggests that CWD, like other TSEs, is caused by prions, which are abnormal versions of proteins present in the cells of mammals. Some event(s), as yet poorly understood, causes the shape of normal cellular proteins to change into the abnormal form. Once this occurs, the abnormal prions become resistant to enzymes which would normally break them down. They also acquire the ability to convert normal proteins into the abnormal form. Consequently, the abnormal prions accumulate and multiply, particularly in nervous and lymphoid tissues, and cause nerve cell death. This in turn results in the principal clinical signs of abnormal behavior and marked body weight loss. CWD is uniformly fatal once these signs arise, because no curative treatment is available.

Evidence suggests that CWD prions are most likely shed in the feces and saliva of infected animals (Miller et al. 2004), eaten by susceptible animals, taken up by digestive tract-associated lymphoid tissues (Sigurdson et al. 1999), and subsequently migrate in adjacent nerves to the brain (Sigurdson et al. 2001). Transmission can occur directly from animal to animal, or indirectly from contaminated environments (Miller et al. 2004). Practices which concentrate animals (such as baiting and feeding, or maintenance in captivity) likely increase transmission rates. CWD is characterized by a prolonged incubation period of 15 months or longer, meaning that infected animals may show no obvious signs of illness yet are capable of spreading infection. This poses problems for disease control, since asymptomatic but infected cervids may be shipped over large distances, acting as sources of CWD, without the knowledge of those transporting them.

Because CWD belongs to the same family of TSEs as Bovine Spongiform Encephalopathy (BSE, commonly called "Mad Cow Disease"), considerable concern has arisen that the disease might be capable of infecting humans. Yet, critical evaluation of the scientific data available to date suggests that the risk, if any, is low (Belay et al. 2004).

1.2.2 *History*. The precise time and geographic origin of CWD cannot be determined with any epidemiological certainty (Williams and Miller 2002; Williams et al. 2002). In spite of this, many theories of widely varying scientific credibility have been suggested. What is certain is the timeline of the disease as described in published scientific articles. Briefly, a "chronic wasting disease" was first recognized as a syndrome of captive deer in Colorado (CO) research facilities in 1967 (Williams and Young 1980), although the cause was not recognized to be a TSE until 1978. Soon after determination of cause, the disease was found in free-ranging elk in 1981 (Spraker et al. 1997), first in CO then in Wyoming (WY). The disease was found in free-ranging mule deer in 1985 and WTD in 1990 in both states (Williams and Miller 2002). CWD has subsequently been diagnosed in free-ranging cervids in Nebraska (NE), Saskatchewan (SK), and South Dakota (SD) in 2001, in Wisconsin (WI), Illinois (IL), and New Mexico (NM) in 2002, and in Utah (UT) in 2003.

CWD was first diagnosed in C/P-OC in SK in 1996 and in SD in 1997. That same year, a CWD infected elk was shipped from SK to South Korea and diagnosed positive in 2001. This was the first extension of the disease outside of North America and underscores the very real risk of geographic spread by human-assisted movement of infected animals. It also prompted the U.S.

Department of Agriculture (USDA) to declare an animal health emergency because of CWD in farmed elk. Subsequently, infected C/P-OC facilities were diagnosed in Alberta (AB), CO, Kansas (KS), Minnesota (MN), Montana (MT), NE, Oklahoma (OK), SD, SK, and WI.

Well referenced, detailed histories of CWD current to 2002 (SCWDS 2002; Williams and Miller 2002; Williams et al. 2002) are available to the interested reader.

1.2.3 *Relevance*. CWD is contagious, and epidemics of the disease are self-sustaining in both C/P-O and free-ranging deer and elk (Miller and Wild 2004; Miller et al. 1998, 2000). Currently the geographic distribution of CWD in free-ranging cervids is relatively limited and the natural rate of expansion has been slow (Williams et al. 2002). Nevertheless, there are concerns, and in the opinion of some, evidence (Nebraska Game and Parks Commission 2002; Williams et al. 2002), that CWD can be spread much more widely and rapidly with human assistance, through movement of live animals or carcasses. Given CWD's known persistence in the environment (Miller et al. 2004), its ability to infect over 80% of the animals in a WTD herd within 4 years of initial exposure (Miller and Wild 2004), its high probability of becoming established once it has been introduced into a population (Miller and Williams 2003), and disease models which project high rates of death in affected populations (Gross and Miller 2001), concern for risks to the health of both C/P-O and free-ranging Michigan cervids is clearly warranted. Introduction into Michigan's C/P-OC population would result in substantial costs to producers due to quarantines and loss of sales, and indemnity costs for government. The importance of free-ranging deer and elk to both the culture and economy (Joly et al. 2003) and the threat of unsubstantiated human health concerns about CWD eroding public participation in hunter harvest (Williams et al. 2002) make the potential consequences of CWD introduction even more grave. In short, CWD clearly has the potential to impair the long-term viability of both cervid farming and wildlife management in Michigan.

1.3 The Michigan CWD Task Force[3]

1.3.1 *Origin*. The extension of CWD over nearly 1,000 miles from western states into WI and IL resulted in an increase in surveillance and preparedness programs (MDNR/MDA 2002) in the eastern United States. In Michigan, this urgency was reflected in Governor Jennifer Granholm's Executive Order 2003-5 (Granholm 2003a), which created the CWD Task Force in February 2003. Because CWD "threatens more than elk and deer in Michigan" and citing CWD's "potential to negatively impact other wildlife populations, limit interest in recreational and commercial use of deer and elk, and negatively impact rural economies," the Governor created the Task Force to develop "a coordinated state response … to keep the disease out of Michigan." The Task Force was to "act in an advisory capacity to the Executive Office of the Governor" and was charged with 5 primary responsibilities:

1. review existing State efforts regarding the prevention of CWD;
2. develop and make recommendations to implement a comprehensive and coordinated state CWD prevention plan;
3. make recommendations on the clarification of enforcement authority to prevent the spread of CWD into Michigan and, if ever detected in Michigan, to prevent its spread within this state;
4. recommend a process for the development of a widely-accessible reference database of available and current information concerning CWD; and
5. identify mechanisms to promote effective communications and coordination of efforts between state, federal, provincial, and local officials regarding CWD.

[3] A comprehensive presentation of the CWD Task Force's membership, activities, and related documents is available online at http://www.michigan.gov/cwd .

The Task Force was composed of 5 voting members appointed from the public by the Governor, and ex-officio members from the Michigan Departments of Agriculture, Community Health, Environmental Quality, Natural Resources, State Police, and Transportation. The Task Force was to report its findings by September 19, 2003, later extended by the Governor to October 15, 2003 (Granholm 2003b).

1.3.2 *Activities.* The Task Force conducted a series of public meetings between June 2 and September 16, 2003. The meetings focused on invited presentations by experts concerning a variety of aspects of CWD biology, surveillance, and management in both free-ranging and C/P-OC. Presentations were followed by question and answer sessions for both the Task Force and the public and finished with public comments. Minutes of all 4 public meetings are available online at http://www.michigan.gov/cwd/ .

1.3.3 *Recommendations.* Following these meetings and additional information gathering from State agency staff, the Task Force issued its Final Report on October 15, 2003 (Michigan CWD Task Force 2003). In introducing its recommendations, the Task Force noted that "it is evident that Chronic Wasting Disease (CWD) poses a major threat to Michigan in direct and indirect ways" and that "CWD is also a special challenge because of gaps in our knowledge of this disease." While recognizing "a difference in culture and perspective" among agriculture and natural resource agencies and their respective stakeholder groups, the Task Force emphasized "the need to use the different expertise and perspectives of all … to strengthen the prevention and/or response to CWD." In addition, the Task Force pointed out "the state's response to bovine tuberculosis has given … a distinct advantage" and that, "Preventive actions make sense, even before all of the scientific questions are answered. … Where the body of scientific evidence shows a likelihood of unacceptable risks, policy makers should consider preventative actions, taking into account economic, social and environmental consequences."

The Task Force issued 12 recommendations. The third recommendation stated "that an immediate audit of Michigan's captive cervid industry be conducted, not to be punitive, but to find any flaws or weaknesses in the current system that might lead to the entrance of CWD into Michigan's captive and wild cervid herds." Elaborating, the Task Force noted:

> Legislative acts P.A. 190, along with P.A. 466, provide a framework for enforcement requirements; however, the implementation and execution of these requirements need immediate review and attention. The task force is especially concerned about: potential escapes from captive facilities; secure borders to prevent escapes; the limited diagnostic testing that is taking place; the integrity of records; potential illegal movements of animals; the need for permanent and unique animal identification; and issues of carcass disposal and captive facility inspection. An audit is needed to provide a more complete understanding of the captive cervid industry and to provide the basis for assigning agency responsibilities for law enforcement and the development and management of the database and record-keeping system (Michigan CWD Task Force 2003, pp. 12-13).

1.4 Executive Order 2004-3 and the origin of the audit. Against this backdrop, Governor Granholm issued Executive Order 2004-3 in April 2004 (Granholm 2004). Since the Task Force recommended "the licensing, application, registration, and inspection functions for privately-owned cervidae livestock facilities and operations be transferred to the Department of Natural Resources" and "a complete audit of Michigan's privately-owned cervidae livestock facilities and operations, which under current budgetary conditions can most effectively be performed by the Department of Natural Resources," the Executive Order implemented both recommendations, effective June 15, 2004.

2. Planning of the audit

2.1 Organization. Preparations for the audit began in May 2004. Staff from the Law Enforcement (LED) and Wildlife (WLD) Divisions of the MDNR were assigned to 6 committees, with responsibilities as follows:

- Questionnaire and Audit Committee: Charged with development of 1) a questionnaire to be administered during facility visits (Appendix A, Exhibit 1); 2) a database to store information gathered during the audit; and 3) inspection procedures to be followed by audit teams (Appendix A, Exhibit 2).
- Risk Factors and Inspection Priority Committee: Charged with 1) prioritizing facilities for inspection based on available MDA data on risk factors for introduction/propagation of CWD (e.g., importation of C/P-OC, history of CWD testing, history of biosecurity problems, etc.) and 2) development of a biosecurity protocol for pen inspections.
- Training Committee: Charged with 1) development of training materials and 2) organization and implementation of training sessions for staff inspecting C/P-OC facilities.
- Communications Committee: Charged with 1) production and distribution of training materials and 2) coordinating and assisting communications between committees.
- Finance Committee: Charged with 1) securing financial and personnel resources to support conduct of the audit and 2) tracking staff hours and expenses.
- Data Analysis and Final Report Committee: Charged with 1) coordinating receipt and storage of data generated during the audit; 2) monitoring inspection schedule/progress; 3) preparation of weekly reports for the LED and WLD Chiefs during conduct of the audit; and 4) compilation and analysis of data gathered during the audit and production of the Final Report

In addition, each Division appointed an inter-divisional coordinator to oversee audit activities. These were temporary, dedicated assignments, during which the audit became the top priority for these individuals.

2.2 Data sharing with the Michigan Department of Agriculture. Executive Order 2004-3 (Granholm 2004) provided that "The Department of Agriculture shall share with the Department of Natural Resources information … regarding privately-owned cervidae livestock facilities and operations … and information necessary for the Department of Natural Resources to conduct an audit of the privately-owned cervidae livestock facilities." On May 17, 2004, staff from MDNR Wildlife Division and the MDA Animal Industry Division (AID) met to transfer AID data regarding C/P-OC operations. MDA staff offered full cooperation and provided 5 tables/databases which housed MDA's accumulated information on C/P-OC, as follows:

- *Facility registration information.* These data included facility identification (ID) number, contact information, location, zoning, acreage, description of fencing and animal ID, findings from MDA facility inspection, and registration expiration date (if a final registration had been issued).
- *CWD test results*. These data included Michigan State University (MSU) Animal Health Diagnostic Lab (AHDL) case and animal ID numbers, "condition" (culled, died, etc.), species, sex, age, name of person submitting, location, test method and results, and dates received and recorded.
- *Bovine tuberculosis (TB) test results.* These data included facility ID number, facility name and location, species, test type and date, and tallies of the number of animals testing positive, reactor, suspect, and negative.
- *Compliance investigations*. This information included responsible party, contact information, AID program area, case number, opening and closing dates, outcome, and summary.
- *Quarantines*. This information included owner, contact information, species, quarantine number, reason for quarantine, and dates of issuance and release.

In addition, MDA made their facility-specific files available for MDNR review of animal movement records and the frequency of documented movement of C/P-OC into and out of facilities. MDNR and MDA agreed to take steps to protect the confidentiality of sensitive information.

2.3 Formulation of risk factors for CWD introduction and prioritization of inspections.

2.3.1 *Facility inspection priority ranking*. The Risk Factors and Inspection Priority Committee used available MDA and MDNR data to derive risk factors and facility priority rankings in the event that all targeted Class III (Ranches) and Class IV (Full Registration) facilities could not be inspected due to time or resource constraints (Appendix D). Because all Class III and IV facilities were inspected, the prioritization ranking was never used during the audit.

2.3.2 *Ranches and Full Registration facilities*. A variety of general characteristics of Class III and IV facilities, including facility size, greater animal numbers, and greater animal movement into and out of these categories of facilities, theoretically provide a greater risk of introduction/propagation of CWD. Consequently, the decision was made to inspect all Ranch and Full Registration facilities recorded in the MDA database during the initial phases of the audit.

2.3.3 *Hobby and Exhibition facilities.* The priority to inspect all Class III and IV facilities reduced the likelihood that all Class I (Hobby) and II (Exhibition) facilities could also be inspected within the established timeframe. However, to characterize Class I and II facilities, a formal random sample of facilities proportional to their representation in the total population was chosen for inspection. Audit teams were to inspect these after completing the Class III and IV facilities.

Using random seeds from a uniform distribution, a random number was formally generated and assigned to each facility in the Class I and II categories (Excel 2000, Microsoft Corporation, Redmond, WA). Using a second random seed, a separate random procedure was used to select a sample without replacement of these facilities for inspection.

2.4 Training. A 3 day training session was developed by the Training Committee to train all LED and WLD field staff on the background for the audit and issues relevant to inspection of facilities. Working cooperatively with the Communications Committee, the Training Committee developed comprehensive training manuals for each training session participant. Two training classes were held in June 2004 to accommodate the number of individuals who needed to be trained. Training topics and presenters can be found in the Agenda, included as Appendix A, Exhibit 3. Training sessions included the participation of MDA veterinarians to train field staff on conduct around C/P-OC and biosecurity, a presentation by a representative of the Wisconsin Department of Natural Resources on their audit of C/P-OC facilities, and the invited attendance and participation of representatives of the Michigan Deer and Elk Farmers Association. Sessions for each of the training groups concluded with field visits to C/P-OC facilities for orientation and practice in the use of Global Positioning System (GPS) techniques.

3. Methods/executing the audit

3.2. Composition of audit teams. A team consisting of a WLD field biologist and a LED conservation officer was assigned to audit facilities in the vicinity of their work station locations. In some cases, a second local conservation officer was also invited to participate. Teams were tasked with scheduling and conducting all assigned audits prior to the end of the fiscal year (September 30, 2004).

3.3. Preparation for audit inspections. At the training session, each team received packets containing summary information specific to each assigned facility including contact information, a questionnaire (Appendix A, Exhibit 1), a C/P-OC facility inspection report (Appendix A, Exhibit 4), a photo documentation log form (Appendix A, Exhibit 5), a sick animal protocol form, and a GPS user reminder sheet (Appendix A, Exhibit 7). The conservation officer also received an informational packet to be given to the facility representative that contained existing C/P-OC regulations and fencing requirements, as well as a background letter concerning the audit (Appendix A, Exhibit 6).

As a part of biosecurity protocols, each biologist and conservation officer received knee-high rubber boots to be worn during inspections and disposable coveralls to be worn if more than one inspection was conducted on the same day. Teams received powdered disinfectant (Virkon S, Antec International, Sudbury, Suffolk, United Kingdom) for preparation of decontamination solution for foot baths. Each team was also issued extendable poles, marked at 8 and 10 feet, to measure fence height.

3.3 Progress of a typical facility audit inspection.

3.3.1 *Contact.* A mailing was sent to all facilities in the MDA database concerning the transfer of regulation and the upcoming audit (Appendix A, Exhibit 6). An audit team member contacted the facility representative and scheduled a mutually-agreeable time to audit each facility. The initial contact usually occurred at least one week prior to the audit.

3.3.2 *Biosecurity considerations*. The audit teams brought water along to prepare a decontamination foot bath solution in a shallow rubber tub according to the manufacturer's instructions. The inspectors washed their rubber boots, already cleaned of organic debris, in the solution prior to inspecting the perimeter fence (Figure 3.1). Boots were washed again at the conclusion of the inspection. If an inspection team conducted 2 or more inspections in the same day, Tyvek disposable coveralls (Figure 5.1, upper left photo) were worn during the second and subsequent inspections. Prior to leaving the facility, teams also decontaminated any inspection equipment that came into contact with animals or areas occupied by animals. Separate areas for clean and contaminated items were maintained in the audit team's vehicles. To the extent possible, teams left used disposable items at the facility for disposal. Because it was biodegradable, residual decontamination solution was poured out on the ground prior to departure.

3.3.3 *Questionnaire administration and examination of records.* Audit teams examined C/P-OC records during and after administration of the questionnaire. Inspection team members examined annual inventory logs sent to MDA, monthly fence inspection records, TB and CWD testing documents, and the MDA registration certificate for the facility.

3.3.4 *Fence inspection and documentation*. The biologist, conservation officer, and facility representative walked or drove the perimeter of the fence and identified fence faults (e.g. holes, non-operating gates, inadequately secured gaps between sections, faulty poles, habitat features such as mounds or creeks which could act as sites of ingress/egress, etc.). Inspection teams measured fence height and height at the bottom edge of the fence if above ground level (Figure 3.2). They also inspected gates for height and gaps in the frame of the gate. Inspectors measured

total fence height in several locations, along with any gaps from the bottom of the fence to the ground.

Audit teams were provided specific tools and training with those tools to assist documenting the facility conditions at the time of the facility inspection. Photographic documentation was used to help assess and record instances of non-compliance and to act as a baseline measure of conditions for re-inspection teams. The conservation officer took photographs of any potential fence or gate faults and all identified instances of non-compliance. Sony digital cameras (Mavica model, Sony Corporation, Tokyo, Japan), were used to capture images with "normal JPG" image compression with a minimum resolution of 640x480 pixels. Most photographs were at a resolution of 1024x768 pixels. The conservation officer documented each photograph on a photo log sheet for each individual facility, identifying the object(s) or problem(s) photographed, the date of photo capture, a GPS coordinate location, the digital camera photograph number, and a short description of the documented objects(s) or problem(s). The digital photographs were transferred to the conservation officer's laptop computer then downloaded to a MDNR server in Lansing for review and compilation with other data.

For perimeter fence-line inspection and documentation, staff used handheld GPS units (Garmin GPSMAP76 models including GPSMAP76, GPSMAP76s, or GPSMAP76sc units, Garmin International Inc., Olathem, KS, USA). Teams had prepared instructions (Appendix A, Exhibit 7) and manufacturer's manuals to standardize spatial data collection methods. Inspectors traversed the fence perimeter and recorded their path using the "track" function of the GPS unit, following selected GPS settings. Once acquired, perimeter data were downloaded to a local computer as either text or shapefile (native ArcView file format for ArcView GIS software, Environmental Systems Research Institute Inc., Redlands, CA, USA), then forwarded to Lansing electronically via MDNR network connections for processing and quality-control review to generate digital fence perimeter files.

3.3.5 *Discussion of results with facility representative*. Before conducting an audit inspection, the conservation officer provided an information packet to the facility representative. After completion of the audit inspection, the biologist and conservation officer discussed any discrepancies or fence fault issues with the facility representative. The biologist, conservation officer, and facility representative also completed and signed the C/P-OC facility inspection report (Appendix A, Exhibit 4). If issues of non-compliance were identified during inspection that facility could not rectify before the inspection team left, a mutually-agreeable date was established for re-inspection of the facility.

3.4 Data entry, archiving and reporting

3.4.1 *Audit data*. Teams recorded question responses on paper copies of the audit questionnaire and then faxed them to MDNR WLD in Lansing. Responses were transcribed into electronic format via a custom developed data-entry application (Access 2000, Microsoft Corporation, Redmond, WA). Data-entry staff entered responses exactly as written and sought clarification from the audit inspectors where necessary. On occasion, audit inspectors provided additional descriptive details to questions that were intended to have numerical responses. In those cases, staff entered text comments into a comment field with a reference made to the question number for which they had been originally recorded.

Once entered into Access, the data were stored in an SQL database (SQL Server, Microsoft Corporation, Redmond, WA). Upon completion of questionnaire data entry, the electronic data were printed and a supervisor checked them against the paper copy for accuracy and clarity. Final versions of the electronic data were then printed and mailed to the facility owner, with a duplicate kept on file in Lansing. The original questionnaires and any other related documentation, the MDNR Facility Inspection Report, and other records and documentation were archived in the Lansing WLD office.

Figure 3.1. Audit inspector disinfecting boots prior to examining the perimeter fence of a C/P-OC facility.

Figure 3.2. Audit team using a measuring pole and handheld GPS unit to inspect the perimeter fence.

GPS coordinates and digital photos were archived separately for each facility. Fence perimeter files were received in Lansing and incorporated into a geographic information system (GIS) database with aerial photographs and other base reference data layers (roads, hydrology, etc.) after careful screen-digitized edits and quality control review. The fence perimeter files were imported into ArcView GIS, reprojected from the native GPS unit coordinates (longitude and latitude values) to the State standard map projection (Michigan GeoReference projection), and overlaid with base data and either 1998 or 1992 aerial photography (digital orthophotography following format standards of U.S. Geological Survey). Attributes were assigned to each facility perimeter, including the facility permit number, calculated area and perimeter, and wildlife management unit. Maps were created for each facility (e.g., Appendix A, Exhibit 8), and these were archived with other facility documents in the Lansing WLD office.

3.4.2 *Cost accounting.* The reporting of audit costs followed State of Michigan accounting practices. Those practices require identification of expenses appropriate for funding sources. Expenses were reported through the State's Data Collection and Distribution System (DCDS) and the Michigan Administrative Information Network (MAIN) system.

Accounting project unit numbers were created to track training costs, hours spent conducting inspections, hours traveling to and from inspections, miles driven, vehicle costs related to miles driven, administrative costs, supplies and equipment, and meals and lodging. Officers and biologists reported hours and costs every other week per State regulations, and costs and hours were summarized separately by MDNR Division (LED or WLD).

3.4.3 *Weekly reports*. Facsimile machine logs were used to determine the weekly and cumulative number of Facility Inspection Reports and questionnaires that had been completed and sent to the MDNR offices in Lansing. The Data Analysis and Final Report Committee created database queries in Access to extract data from the central database concerning 1) the number of C/P-OC facility for which inspection data had been entered into the database; 2) the number of facilities summarily judged as being non-compliant with C/P-OC regulations by inspection teams; and 3) cost and time accounting figures to date. In addition, LED provided data on the number of sets of facility inspection photographs that had been uploaded to Lansing and the number still pending.

Using these data, the Report Committee sent a weekly audit progress report to the LED and WLD Division chiefs. These reports summarized completed audits by WLD Management Unit (MU) and by C/P-OC facility class. The information was incorporated into a spreadsheet (Excel 2000, Microsoft Corporation, Redmond, WA) for ease of reporting and use by project managers (e.g., Appendix A, Exhibit 9).

3.5 Data analysis. Microsoft Access was the end-user software used to access the data on the SQL server for data analysis. First, the Report Committee summarized responses recorded on the questionnaire using the query utility in Access. All question responses not recorded in a text field were summarized both by facility class and MU (to provide insight into potential class and geographic variation). Queries counted the number of positive responses to yes/no questions, counted the number of responses for each choice in a multiple response question, or summed reported numeric values (such as number of cervids in the current inventory). Query results were reviewed to detect risk factors for introduction and propagation of CWD. The report utility in Access was used to summarize results for presentation in appendices in the final audit report.

4. Results

4.1 Review of C/P-OC data as obtained from MDA.

4.1.1 *Facility registration information*: As of May 17, 2004, MDA had recorded 738 C/P-OC facilities statewide. Records for 232 of these facilities (31%) did not have a license expiration date. The issuance of a license expiration date indicated the registration process had been completed for a given facility. MDA assigned facility registration identification numbers upon application. Facilities without a license expiration date were either in a state of construction or had not been formally issued a final registration certificate. A letter from Dr. Douglas Hoort, privately-owned cervid program veterinarian with MDA dated April 11, 2003 indicates that completion of the registration process was suspended in order for staff to dedicate time to another project. A summary of facilities without license expiration dates in the database is shown by facility class in Table 4.1.

Table 4.1. Summary counts of Michigan C/P-OC facilities from MDA data, May 17, 2004.

Facility Class	Total statewide	Number (%) of facilities without final MDA registration
I (Hobby)	166	80 (48.2)
II (Exhibition)	33	16 (48.5)
III (Ranch)	141	37 (26.2)
IV (Full Registration)	398	99 (24.9)
Total	738	232 (31.4)

Two hundred thirty-nine facilities (32%) did not have a current herd inventory on file with MDA. For 197 of these 239 facilities (82%), the inventory on file was either dated (≥2 years old) or absent.

4.1.2 *CWD test results*: An MDA database contained 2,085 CWD test results for C/P-OC from January 2002 to May 17, 2004. Three hundred eighty-five (18%) test records were from species not known to be susceptible to CWD.

The database used by MDA was incomplete in content. The registration number of the facility from which the animals were tested was not included as a field in the database, so facility of origin could only be determined indirectly by the name of the person submitting the test or by consulting another database of animal identification numbers. Ten records were for animals that appeared not to have unique traceable identification. In 74 records (3.5%), the name of the person who submitted the animal for testing was not recorded, although 64 of those records were for animals identifiable by a USDA TB ear tag number, which can sometimes be linked to owner and facility indirectly via a USDA database.

Two-hundred seventy-four test records (13%) were for animals which did not have official USDA identification by which facility of origin could be traced. Thirty-two (1.5%) of the records had no information to identify where the sample originated.

4.1.3 *Compliance investigations*: As of May 17, 2004, MDA had initiated compliance investigations at 39 (5%) of C/P-OC facilities. Eight of these pertained to escaped deer, 7 were unregistered facilities, 6 added cervids to enclosures before MDNR verification that free-ranging deer were absent, and the remainder were investigated for a variety of other issues (e.g., animal movement violations, operating an unregistered facility, making modifications to a facility without notification, refusing inspection, fact finding investigations, etc).

4.1.4 *Quarantines*: As of May 17, 2004, quarantines had been issued for 60 (8%) C/P-OC facilities. Ninety percent of the quarantines were issued because of violations of TB testing regulations.

4.2 Descriptive results of audit inspections. Complete results of questionnaire administration and inspections of C/P-OC facilities are presented in Appendix B. In general, results are tabulated by facility class and WLD Management Unit. Results germane to issues of CWD risk are presented below.

4.2.1 *Number of inspections and inactive facilities.* The locations of all registered Michigan C/P-OC facilities (as of April 20, 2004) are shown in Appendix C, Figure 1. MDNR staff identified two other facilities (one Class III and one Class IV) which were inspected and are included in these results (Appendix B, Table1a). Beginning on June 1, 2004 and ending on October 26, 2004, teams inspected 35 of 166 (21.1%) Class I (Hobby), 9 of 33 (27.3%) Class II (Exhibition), 142 of 142 (100%) Class III (Ranch) and 398 of 399 (99.7%) Class IV (Full Registration) facilities (Appendix B, Figure 1). Access was denied by 1 Full Registration facility; LED operations to gain access were still underway at the time of this writing. Because all but 1 Full Registration and all Ranch facilities were inspected, their results are summarized together and should be considered a census of the total population. Because the Hobby and Exhibition facilities inspected were a representative sample of all Hobby and Exhibition facilities, they are summarized separately from the other 2 facility classes.

Fifty-four Full Registration, 17 Ranch, 1 Exhibition, and 6 Hobby facilities were inactive (i.e., did not contain cervids) at the time of inspection (Appendix C, Figure 2). Of the 78 inactive facilities, 35 (44.9%) were categorized as no longer in business, 36 (46.2%) were not yet complete, and 7 (9.0%) were combined with other facilities with existing registration numbers.

Except where otherwise specified, results refer to only active facilities throughout the remainder of the report. While LED and WLD staff took all reasonable measures to identify any unknown unregistered facilities, some may still exist. Consequently, facility totals contained herein should be considered minimum numbers.

4.2.2 *Susceptible species*. During the period of the audit, a minimum of 32,493 total C/P-OC were housed in all facilities inspected statewide based on facility owner information. More than 30,000 (30,616 or 94.2%) of those animals were of species known or anticipated to be susceptible to CWD (Appendix B, Table 4a). The vast majority (25,976 or 84.8%) were WTD. Elk were second most common in abundance at 4,029 animals, about 13.2 %, and 611 animals (2.0%) were red deer (*Cervus elaphus elaphus*). Full Registration facilities housed 13,840 (42.6%) C/P-OC while Ranches housed 18,394 (56.6%). These figures are conservative, because young of the year were incompletely counted at the time of the audit, particularly on Ranch facilities. Animals of unknown gender were not reported in a numerical data field and were not included in total numbers of animals. The sample of Hobby and Exhibition facilities inspected housed 196 animals of species susceptible to CWD of which 176 (89.8%) were on Hobby facilities. The majority of susceptible animals (115 or 58.7%) in the Class I and II sample were WTD. Only 20 of 71 (28.2%) C/P-OC found in Class II facilities inspected were species susceptible to CWD.

4.2.3 *Co-mingled species*. For active Ranch facilities, 50 (40%) co-mingled cervid species and among those, 41 co-mingled at least 2 CWD-susceptible species (Appendix B, Table 5a). Forty-one (11.9%) Full Registration facilities co-mingled cervids, and 16 (39%) of those facilities co-mingled at least 2 CWD-susceptible species. Only 1 Hobby facility from this sample (3.4%) co-mingled 2 susceptible species and 1 Exhibition facility (12.5%) co-mingled 2 cervid species not susceptible to CWD.

4.2.4 *Adjacent pens.* Several facilities housed different cervid species in adjacent pens where individuals had nose-to-nose contact through a fence (Appendix B, Table 5a). Twenty-six active

Ranch facilities (20.8%) had different species in adjacent pens, and 15 (57.7%) of these facilities had different CWD-susceptible species housed in adjacent pens (e.g., WTD adjacent to elk). For Full Registration facilities, 83 (24.1%) had different cervid species in adjacent pens, and 29 of these (34.9%) housed different susceptible species in adjacent pens. Two inspected Hobby facilities (6.9%) housed different cervid species in adjacent pens, and 1 (3.4%) housed susceptible species in adjacent pens. One Exhibition facility (12.5%) housed different cervid species in adjacent pens but species were not susceptible to CWD.

4.2.5 *Diet supplements*. Of the 125 active Ranch facilities, 119 (95.2%) fed dietary supplements to C/P-OC, while 336 of 344 (97.6%) Full Registration facilities did (Appendix B, Table 5a). Seven of 8 (87.5 %) Exhibition and 28 of 29 (96.6%) of the Hobby facilities inspected also fed supplements. Pelleted commercial feed blends, grain, and produce were most commonly fed.

4.2.6 *Cervid identification*. Information regarding animal identification was not recorded outside of text comments for 13 facilities. A majority of Ranch facilities (69 of 125 or 55.2%) answered that all animals in their facilities had individual identification (Appendix B, Table 6a). All cervids on the majority of Full Registration facilities, 307 of 344 (89.2%), had some manner of individual identification. All cervids on 18 of 29 (62.1%) Hobby facilities and 7 of 8 (87.5%) Exhibition facilities inspected had individual identification. Fifty-five facilities had individually identified some cervids and had not individually identified other cervids on the same premises. For Full Registration facilities, 24 (7%) had individually identified some but not all individuals on the facility; comparable figures for the other classes were 27 (21.6%) Ranches, 0 Exhibition facilities, and 4 (13.8%) Hobby facilities. Six (20.7%) Hobby, 1 (11.1%) Exhibition, and 8 (2.3%) Full Registration facilities did not individually identify any cervids at all. Twenty-two (17.6%) Ranch facilities also did not individually identify any cervids in their business.

The average age when animals were marked varied from 4.5 months in Full Registration facilities to 9.8 months in Exhibition facilities. Most (224 of 344 or 65.1%) Full Registration facilities marked cervids before the animals were more than 12 months of age (Appendix B, Table 7a). Eight of 29 (27.6%) Hobby, 3 of 8 (37.5%) Exhibition, 43 of 125 (34.4%) Ranch, and 229 of 344 (66.6%) Full Registration facilities used multiple identification methods. For example, a facility may use electronic identification for some individuals and ear tags for others. (Appendix B, Table 6a). Most Full Registration and Ranch facilities used USDA metal ear tags affixed during TB testing along with other plastic ear tags to identify cervids, but some facilities used only one or the other (Appendix B, Table 7a).

4.2.7 *Escapes and intentional releases*. C/P-OC producers reported that during the last 4 years, 464 cervids had escaped from 69 (20%) active Full Registration and 18 (14.4%) Ranch facilities, with 87.9% (408) of those reported escaped animals from Class IV facilities (Appendix B, Table 9a). Six (20.7%) Hobby facilities reported 9 escapes, while 2 (25%) Exhibition facilities reported 2 escapes. Of the 506 active facilities inspected, 411 (81.2%) reported no escapes. Consistent with their representation among all C/P-OC, the most common species to escape were WTD and elk.

Low fences, open gates, holes in fences due to blown down trees/limbs from storms, and mishandling of animals were all given as reasons for escapes (Appendix B, Table 10a,b). Individual animal identification was practiced in 9 of 18 (50.0%) Ranches where animals escaped, and on 56 of 69 (81.2 %) Full Registration facilities (Appendix B, Table 9a). Cervids were individually identified in 4 of 6 (66.7 %) Hobby facilities where cervids escaped, and on 1 of 2 (50 %) Exhibition facilities.

Reported recovery rates were 8 of 9 (88.9%) escapes for Hobby facilities, 3 of 2 (150%) for Exhibition facilities, 34 of 45 (75.5%) for Ranches, and 379 of 408 (92.9%) for Full Registration facilities (Appendix B, Table 9a). The reported recovery or escape rate of Class II

facilities is clearly suspect. The amount of time that cervids were outside the perimeter fences is unknown.

Only 1 of 18 (5.6%) Ranch facilities and 10 of 69 (14.5%) Full Registration facilities placed escaped C/P-OC in an isolation facility after recovery. One of 6 (16.7%) Hobby facilities placed escaped cervids into isolation after recovery (Appendix B, Table 9a). Operational standards require that animals that have escaped for more than 12 hours ("released") be placed in an isolation facility. No isolation requirement is necessary if the animal is recovered before 12 hours after escape.

Three (0.9%) Full Registration facilities and 1 (0.8%) Ranch facility reported intentionally releasing C/P-O WTD into the wild (Appendix B, Table 11a).

4.2.8 *Reported deaths and CWD testing.* During the last 4 years, 17,527 C/P-OC mortalities were reported by active Full Registration and Ranch facilities in Michigan, or an average of 4,382 animals per year (Appendix B, Table 12a). Ranch facilities recorded 12,530 deaths while Full Registration facilities had 4,997 deaths. On the sample of Hobby and Exhibition facilities, 84 animals were reported to have died in the last 4 years, or an average of 21 animals per year.

On Full Registration and Ranch facilities, most deaths (12,259 or 69.9%) were due to harvest, 914 (5.2%) animals died from illness, and 4,354 (24.8 %) reportedly died from other causes, (trauma from running into fences primarily during TB testing, fighting, or predation by wolves, dogs, and coyotes). A total of 368 cervids died from illness in Ranch facilities, and 546 cervids died from illness in Full Registration facilities. Both Ranch (36 or 28.8%) and Full Registration (79 or 23.0%) facilities reported having necropsied at least 1 cervid death

For the Exhibition and Hobby facilities, 54 (64.3%) cervids died of other causes and an equal number (15 or 17.9 %) each died from harvest and illness. Six facilities necropsied at least 1 cervid death.

Among all Class III and IV facilities inspected, the facilities in the NE MU had the highest percentage of illness deaths (165 of 3,071 total deaths, 5.4 %), and the lowest number of illness deaths (13 of 798 total deaths, 1.6 %) occurred in the WUP MU (Appendix B, Table 12b).

MDA has maintained a mandatory CWD surveillance program since September 1, 2002. All C/P-OC over 16 months of age that are culled, euthanized due to illness, or found to be dead, must be tested for CWD. In the case where a large number of animals are culled, MDA requires a representative sample to be tested – usually 25% of the animals over 16 months of age that are culled. Combined Ranch and Full Registration facilities reported 1,962 animals have been tested for CWD (Appendix B, Table 12a). Ranch facilities tested 1,068 animals for CWD, while Full Registration facilities tested 895 animals for CWD. On the sample of Hobby and Exhibition facilities, 9 animals have been tested for CWD. Because the questions asked covered a longer period than the mandatory testing requirement, and because ages of animals were not reported, it is difficult to estimate the level of testing for CWD that has been done since mandatory requirements were implemented. Many facilities did not test any dead cervids for CWD, but others did test regularly (Appendix B, Figure 6). Full Registration facilities were responsible for most of the testing overall (Appendix B, Figure 6).

4.2.9 *Carcass disposal.* Some active facilities recorded no deaths on the premises, so carcass disposal does not pertain to every facility inspected. In addition, some facilities disposed of carcasses in multiple places, so total answers for each category used to calculate percentages will sometimes total >100%.

With respect to site of disposal (Appendix B, Table 14a), 3 Ranch facilities (2.3%) disposed of carcasses off-site but not in a licensed landfill, 10 (7.7%) disposed of them at a licensed landfill, 31 (23.8%) disposed of them outside of the C/P-OC enclosure, and 86 (66.2%) disposed of them within the enclosure. For Full Registration facilities, 14 (4.1%) disposed of carcasses at a licensed landfill, 25 (7.3%) disposed of them off-site but not at a licensed landfill,

97 (28.4%) disposed of them within the enclosure, and 205 (60.1%) disposed of them outside the enclosure.

Nineteen (86.4%) of the inspected sample of Hobby facilities disposed of carcasses outside the C/P-OC enclosure, and 3 (13.6%) disposed of them within the enclosure. For the inspected sample of Exhibition facilities, 4 (50.0%) disposed of them off-site but not at a licensed landfill, 1 (12.5 %) disposed of them within the enclosure, and 3 (37.5 %) disposed of them outside the enclosure.

Facilities disposed of carcasses using a variety of methods (Appendix B, Table 13a). Six (4.1%) Ranch facilities rendered them, 62 (42.5%) buried them >3 feet deep, 27 (18.5%) buried them <3 feet deep, 30 (20.5%) left carcasses above ground, and 21 (14.4%) disposed of them by some other method. For Full Registration facilities, 6 (1.7%) rendered, 201 (56.5%) buried >3 feet deep, 71 (19.9%) buried <3 feet, 28 (7.9%) left carcasses above ground, and 50 (14.0%) disposed of them by other methods.

Among the inspected sample of Class I and II facilities, 13 (59.1%) Hobby and 3 (42.9%) Exhibition facilities buried carcasses >3 feet deep, 6 (27.3%) Hobby and 1 (14.3%) Exhibition buried them <3 feet, 1 (4.5%) Hobby and 1 (14.3%) Exhibition left carcasses above ground, and 2 (9.1%) Hobby and 2 (28.6%) Exhibition disposed of them by some other method.

4.2.10 *Purchases and sales of scent, semen and velvet antler* (Appendix B, Table 15a,b).

Scent. Only 5 Full Registration (1.5%) and 1 Ranch (0.8%) facilities in the State reported selling cervid scent and no facilities purchased it. One sampled Exhibition facility (12.5%) bought and sold cervid scent.

Semen. Five (1.5%) Full Registration facilities both purchased and sold cervid semen, 40 (11.6%) only purchased semen, 8 (2.3%) only sold semen, and 291 (84.6%) neither purchased nor sold semen. Seven (5.6%) Ranch facilities only purchased cervid semen, 2 (1.6%) facilities only sold semen, and 116 (92.8%) neither sold nor purchased semen. None of the Hobby and Exhibition facilities inspected bought or sold cervid semen.

Velvet antlers. Full Registration facilities reported selling 613 velvet antlers, while Ranches sold only 2. No Hobby or Exhibition facilities inspected sold cervid antlers.

Urine. One Full Registration facility (0.3%) reportedly only purchased cervid urine, 7 (2.0%) only sold cervid urine, and 336 (97.7%) neither purchased nor sold cervid urine. Only 1 Ranch facility (0.8%) reportedly sold cervid urine, while 124 (99.2%) did not purchase or sell it. One Exhibition facility (12.5%) in the inspected sample bought and sold cervid urine.

4.2.11 *C/P-OC purchased out-of-state and state of origin*. MDA prohibited importation of live C/P-OC into Michigan in April of 2002. The audit questionnaire asked about animal movements into the state during the past 3 years, which would include 2 years when such movements were prohibited; thus the following results largely reflect movement in the year preceding the ban on importation. During the last 3 years, 733 C/P-OC were purchased from out-of-state by all active facilities inspected (Appendix B, Table 16a,b). Thirteen (10.4%) Ranch facilities brought in 540 (73.7%) of all the cervids purchased out-of-state, while 45 (13%) Full Registration facilities brought in 190 (25.9%). Only 1 (3.4%) Hobby facility and 1 (12.5%) Exhibition facility inspected brought animals in from out-of-state.

Of the sample of facilities audited, all Exhibition and Hobby facilities that imported cervids from out-of-state tested all animals for TB. Two of 13 (15.4%) Ranches and 9 of 45 (20%) Full Registration facilities importing C/P-OC from out-of-state did not TB test all of the imported animals. The Animal Industry Act (AIA 1988, p. 22), however, does not require a negative TB test for each individual animal, provided the animal originated from an official TB accredited herd or was born in and originated directly from an official TB qualified or monitored herd.

As livestock, C/P-OC imported into Michigan from out-of-state are required to be accompanied by an official interstate health certificate or certificate of veterinary inspection (AIA 1988, p. 14). Cervids brought in by 6 of 45 (13.3%) Full Registration facilities, 1 of 13 (7.7%) Ranches, and the 1 Hobby facility did not have such certificates, while the Exhibition facility did.

During the last 3 years, 19 animals from 5 of 45 (11.1%) Full Registration facilities and 104 cervids from 2 of 13 (15.4%) Ranch facilities were reportedly purchased through animal brokers. Exhibition and Hobby facilities inspected did not report using animal brokers for out-of-state purchases

4.2.12 *Importation of C/P-OC from CWD-positive states*. We considered any information on imports of cervids from CWD positive states critical to the assessment of risk. Consequently, we did not limit examination of cervid imports from CWD positive states to active facilities, and denominators used to calculate percentages differ slightly from those presented in other sections of the results.

At some point in their operation (Appendix B, Figure 2) 12 Ranch facilities of 142 total (8.5%) imported C/P-OC from CO, MN, WI, and/or AB, Canada, and 25 of 399 (6.3%) of Full Registration facilities imported animals from IL, MN, SD, or WI in the US and/or from AB and SK, Canada (Appendix B, Table 3a,b). Most of these (21 of 37 or 56.7%) imported animals from WI. All of these states and provinces are now CWD positive. Hobby and Exhibition facilities in the inspected sample did not report importing any C/P-OC from CWD positive states.

4.2.13 *Auctions*. One (14.3%) Exhibition, 9 (7.2%) Ranch, and 56 (16.3%) Full Registration facilities have bought or sold C/P-OC at auction during the last 4 years (Appendix B, Table 2a)

4.2.14 *C/P-OC shipped out-of-state.* Live cervids the MI facilities ship out-of-state must have a TB test before shipment or originate from a TB accredited/qualified/monitored herd. Twenty (5.8%) Full Registration facilities shipped animals out-of-state, of which 18 (90%) reported that all animals were TB tested prior to shipment, and 17 (85%) facilities had a veterinary inspection certificate accompany cervids shipped. None of the Ranch, Exhibition, or Hobby facilities inspected shipped animals out-of-state (Appendix B, Table 17a). It is illegal for Hobby and Ranch facilities to remove live cervids from the premises, although Exhibition facilities are allowed to move animals on a temporary basis (OSRPOCF 2000, p.5).

4.2.15 *Intrastate shipments*. Operational standards prohibit Ranch facilities from transporting live animals off the facility, yet 6 (4.8%) Ranch facilities reported that they had shipped live cervids within MI (Appendix B, Table 18a). All live cervids shipped from Michigan C/P-OC facilities to other facilities within MI must satisfy 1 of a series of TB testing requirements prior to shipment depending on age (AIA 1988, pp. 22-23). Thirteen (10.4%) Ranch facilities reported they had TB tested C/P-OC prior to intrastate shipment. Five had a veterinary inspection certificate accompany these cervids. For Full Registration facilities, 203 (59.0%) facilities shipped cervids intrastate, and 174 (85.7%) reported having TB tested all animals prior to shipment; 65 (32.0%) facilities had a veterinary inspection certificate accompany shipped animals (Appendix B, Table 18a).

Within the sample of active Hobby and Exhibition facilities inspected, 7 facilities shipped 22 live C/P-OC within MI, and 4 (57.1 %) of those facilities reported TB testing animals prior to shipment. One Hobby facility had a veterinary inspection certificate accompany an intrastate shipment.

4.2.16 *Births*. During the last 3 years, 24,991 births have occurred at the C/P-OC facilities inspected statewide (Appendix B, Figure 7). Full Registration and Ranch facilities were responsible for

99.4%, or 24,853 of the births documented. Among the sample of Hobby and Exhibition facilities inspected, 138 births occurred statewide.

4.2.17 *Transfers of C/P-OC between facilities*. During the last 3 years, 41 facilities (37 Full Registration) have transferred male cervids in or out of the facility for breeding purposes; 31 facilities (26 Full Registration) transferred females in or out. One (3.4%) Hobby and 1 (12.5%) Exhibition facility transferred males. Two Hobby facilities (6.8%) transferred females in or out for breeding purposes (Appendix B, Table 19a,b).

Two Ranch (1.6%) and 39 (11.3%) Full Registration facilities have temporarily housed cervids from another facility, while 1 (12.5%) Exhibition and 1 (3.4%) Hobby facility temporarily housed cervids from another facility.

4.2.18 *Record keeping.* Most Full Registration facilities, 280 of 344 (81.4%), kept paper records only, and 63 (18.3%) had both electronic and paper records (Appendix B, Table 23a). For Ranches, most (103 of 125 or 82.4%) kept paper records only, but 22 (17.6%) had both electronic and paper records. One (0.3%) Full Registration facility had no records in spite of the fact that recordkeeping is specifically required (OSRPOCF 2000, p. 2; POCPMA 2000, p. 2). The Hobby facilities inspected had primarily paper records (27 of 29 or 93.1%), but 1 (3.4%) facility had both paper and electronic records and 1 facility did not keep records (although specifically required by law). Seven (87.5%) of 8 Exhibition facilities had paper records and 1 (12.5%) had both electronic and paper records.

The auditors were to determine if overall records were satisfactory and fence inspection records were satisfactory. For the sample of Hobby facilities inspected, 23 of 29 (79.3%) were judged to have adequate overall records and 20 out of 29 (69.0%) had adequate fence inspection records. Six of 8 (75.0%) inspected Exhibition facilities had adequate overall records according to auditors, and 7 of 8 (87.5%) had adequate fence records. Of 344 Full Registration facilities, 287 (83.4%) were considered to have adequate overall records, and 283 (82.3%) to have adequate fence inspection records. Among Ranches, inspectors judged 109 of 125 (87.2%) to have adequate overall records and 112 (89.6%) to have adequate fence inspection records.

Two (5.8%) Full Registration and 2 (1.6%) Ranch facilities reported having been asked to alter C/P-OC records (Appendix B, Table 23a). Two Full Registration facilities reported that they actually had altered their records.

4.2.19 *Fence and gate faults/biosecurity*. Perimeter fences that house WTD must be at least 10 feet tall, and those for elk must be at least 8 feet tall (OSRPOCF 2000, p.1; POCPMA 2000). Inspection teams found numerous facilities in non-compliance with minimum fence height requirements (Appendix B, Table 22a,b). Full Registration facilities had fences too low for the species housed on 160 of 344 (46.5%) facilities, and Ranch facilities had low fences on 62 of 125 (49.6%). Twelve of 29 (41.4%) inspected of Hobby facilities and 1of 8 (12.5%) Exhibition facilities had fences too low.

At the time of inspection, Full Registration facilities had an average (mean) of 1.1 (range 0–20), and Ranches 4.2 (0–250) fence faults per facility. Omitting the single Ranch facility with 250 fence faults, the mean decreases to 2.0 (range 0–20). The sample of Hobby facilities had an average of 0.5 (range 0–4) and the Exhibition facilities 1.8 (range 0–12) faults/facility. Current regulations require that the perimeter fence be inspected monthly for faults; representatives for the vast majority of active facilities, 97.4% (493 of 506), responded that fences were inspected monthly. Ninety-seven percent (335 of 344) of active Full Registration, 98.4% (123 of 125) of Ranches, 100 % (29 of 29) of Hobby facilities, and 75% (6 of 8) of Exhibition facilities reported inspecting fences monthly.

The inspection report sheet included a box where inspectors reported if gates were satisfactory or unsatisfactory. Six of 29 (20.7%) audited Hobby facilities and 1 of 8 (12.5%)

audited Exhibition facilities were judged by auditors to have unsatisfactory gates. For Ranch facilities, 18/125 (14.4%) did not meet gate requirements, and 44 of 344 (12.8%) Full Registration facilities had unsatisfactory gates.

Most C/P-OC in MI could come into contact with free-ranging cervids because these groups were separated by a single perimeter fence which could potentially allow 2 animals to have nose to nose contact through an intact woven wire fence (Appendix B, Table 5a,b). Of active Ranch facilities, 118 of 125 (94.4%) had perimeter fences that allowed potential contact with free-ranging cervids, as did 323 of 344 (93.9%) active Full Registration facilities. Findings were similar for the majority of sampled Hobby, 27 of 29 (93.1%) and Exhibition facilities 7 of 8 (87.5%) as well.

Free-ranging cervids were reported to have been found inside enclosures in 3.8 % (13) of Full Registration facilities and in 20.0% (25) of Ranch facilities. Only 1 Exhibition facility reported that free-ranging cervids had been found in the enclosure.

4.2.20 *Summary compliance status.* Nine of 29 (31.0%) of the inspected sample of Hobby facilities and 5 of 8 (62.5%) Exhibition facilities were judged by inspection teams to be non-compliant with current regulations. Among active Ranch facilities, 45 of 125 (36.0%) were judged non-compliant by inspectors, as were 128 (37.2%) of 344 active Full Registration facilities.

4.3 Inspection team comments. The comment fields in the questionnaire contained useful and interesting information. Poaching deaths were discussed regularly and many facilities had dogs gain entry to enclosures and kill or wound C/P-OC. Fawns reportedly escaped from facilities on occasion, but they were easily recovered and were rarely placed in isolation. Other escaped adult cervids were either killed outside the fence or recovered by owners and rarely isolated after re-capture. In many cases, facility owners did not have exact herd counts at the time of inspection; often the owners did not know the number or gender of fawns born in 2004 because such assessments would normally be done in the fall/winter. Comments also contained data regarding purchases and sales of animals from within state or out-of-state.

Numerous inspection teams commented that facilities had excellent fences and records, but many others commented on facilities with incomplete records. Facility owners often repaired fence faults or compliance concerns in the presence of the inspection teams. Comments indicated that there was often confusion by facility owners on general regulations and laws for C/P-OC, the protocol for closing facilities and going out of business, and paperwork requirements for MDA each year. Several facility owners reported that they did not receive results from MDA concerning CWD and TB testing.

4.4 Cost accounting. Combined audit-related costs for LED and WLD totaled more than $560,000. A breakdown by accounting project unit and MDNR Division (rounded to the nearest hundred) are displayed in Table 4.2.

Table 4.2. Total costs for planning, conducting and reporting, audit of C/P-OC facilities, Michigan, May through October 2004.

Project unit	MDNR Division		**Total cost**
	Law Enforcement	Wildlife	
Training	$30,800	$42,700	**$73,500**
Inspections	$109,900	$124,900	**$234,900**
Travel	$28,200	$23,800	**$52,000**
Administration	$47,400	$81,700	**$129,100**
Vehicle	$23,500	$20,200	**$43,700**
Supplies & Equipment	$4,100	$22,900	**$27,000**
Meals & Lodging	$2,200	$100	**$2,300**
Equipment	$0	$5,600	**$5,600**
Total	**$246,100**	**$321,900**	**$568,000**

5. Discussion

5.1 Risk analysis for introduction of CWD. Discussion of the results of the audit in the context of CWD risk requires the recognition that potential risks associated with C/P-OC facilities could arise at a variety of levels. Consequently, this discussion will examine the audit results in relation to 3 areas of potential risk: management of individual animals, management of C/P-OC facilities, and agency implementation of Act 190 and other regulations currently in force.

5.1.1 *Management of individual animals*

5.1.1.1 Interstate movement

5.1.1.1.1 *Status of current regulatory requirements: live animals.* Effective April 25, 2003 all Cervidae are banned from entering Michigan due to the potential threat of CWD. The following standards applied prior to the moratorium, and will apply when the ban is lifted. The Operational Standards for Registered Privately Owned Cervidae (OSRPOC 2000) states that records on all live animals moved into a facility be kept, including age at entry into the herd, date and method of entry into the herd, and complete name, address, and phone number of the person from whom the animal was acquired. Facility owners must also keep copies of any test certificates, herd status letters, or official interstate or international health certificates required for compliance with any state or federal law, for all animals entering the herd. The sellers must retain the same paperwork. Animals added to the herd must also have official identification appropriate for the facility class. Act 190, the Privately Owned Cervidae Producers Marketing Act (POCPMA 2000), states that anyone transporting a live cervid must produce documentation that contains the origin and destination of the shipment, copies of registration or permits, and all documentation required by Act 466, the Animal Industry Act (AIA 1988). The AIA states that all C/P-OC imported into the state must be accompanied by an official interstate health certificate or an official interstate certificate of veterinary inspection. Cervids older than 6 months that are not going directly to slaughter must originate from a certified brucellosis-free herd or test negative for *Brucella* within 30 days prior to importation.

C/P-OC imported into Michigan that are not going directly to slaughter, and are 1 year or older must:

- originate directly from a tuberculosis accredited herd,
- originate directly from a tuberculosis qualified or monitored herd and receive an official negative TB test within 90 days of importation, or
- be isolated from all other animals until they have received 2 official negative TB tests conducted no less than 90 days apart, with the first test being done no more than 120 days before importation.

C/P-OC imported into Michigan that are not going directly to slaughter, and <1 year of age must:

- originate directly from a tuberculosis accredited herd,
- be born in and originate directly from a tuberculosis qualified or monitored herd,
- be a purchased addition originating directly from a tuberculosis qualified or monitored herd and receive an official negative TB test within 90 days of importation, or
- Be isolated from all other animals until they have received 2 official negative TB tests conducted no less than 90 days apart, with the first test being done no more than 120 days before importation.

C/P-OC that have TB test results other than negative, or that have been exposed to tuberculosis or brucellosis are not to be imported without the permission of the Director of MDA.

5.1.1.1.2 *Status of current regulatory requirements: dead animals.*

5.1.1.1.2.1 Free-ranging. Recent evidence indicates that CWD-infected carcasses can contaminate the environment and transmit the infection to live animals (Miller et al 2004). This evidence suggests that transportation of carcass parts could extend the geographic range of CWD. MDNR regulates carcasses and parts of carcasses of free-ranging cervids that have been harvested by hunters for their own use. Historically, regulations regarding what body parts must be kept with the carcass in transport were enacted primarily to ensure compliance with harvest restrictions on the gender, species, or age of animals. Because of the wide variation in species harvested from state to state, considerable variations in these regulations also occurred. This has proven to be a regulatory challenge since nationwide concerns about CWD arose. As of February 2004, 15 states and 1 Canadian province have put restrictions on the importation of hunter-harvested cervid parts (California (CA), CO, IL, Iowa (IA), Kentucky (KY), MI, MN, North Dakota (ND), NM, New York (NY), Oregon (OR), Rhode Island (RI), South Carolina (SC), UT, Vermont (VT), and Manitoba (MB) and 5 states (MT, North Carolina (NC), New Hampshire (NH), OK, and Pennsylvania (PA)) were discussing similar bans (CWD Alliance 2004). Natural resource agencies are limited in their ability to restrict transport and disposition of hunter-harvested cervid carcasses because the animals cease to be public property and become the private property of the hunter when legally tagged.

Despite these regulations, hunters returning from out-of-state hunts have unknowingly transported carcasses and parts of carcasses of CWD-positive free-ranging cervids from CO, WY, and probably other states, into Michigan. Usually, the hunter has returned home with boned meat from a harvested mule deer or elk prior to knowing the results of CWD testing and has been informed by the state of origin of the animal's CWD-positive status after return to MI. Since the autumn of 2002, MDNR's Wildlife Disease Lab (WDL) has made efforts to obtain the carcasses and parts of such animals so that they can be disposed of properly using high temperature incineration[4]. Efforts to educate hunters about the need to dispose of carcass parts properly, and of MDNR WLD's program, have occurred at the same time. Beginning in 2003, a reciprocal agreement between MI and WY to share test status and contact information for hunters harvesting TB-positive and CWD-positive free-ranging cervids, respectively, has been in place. This has allowed MDNR WDL staff to contact Michigan hunters that harvested CWD-positive WY deer and elk to offer help in properly disposing of any unwanted carcass parts.

Although the potential for spreading CWD geographically by transportation of carcasses and parts has been indicated, there is no evidence to date that this has happened (Miller 2004). Moreover, CWD prions have not been identified in skeletal muscle of naturally occurring cases (Spraker et al. 2002), suggesting that transport of boned meat likely presents minimal risks. Dr. Michael Miller, 1 of the 2 foremost scientific experts on CWD in the world, has pointed out that while it is "probably prudent to recognize and attempt to manage these relatively small risks in some manner … safeguards should not be so onerous that they diminish our ability to control CWD-infected populations through harvest, because removing live, infected animals from these populations will likely be a much more effective overall strategy for controlling CWD than will control via focusing on select animal parts" (Miller 2004).

[4] Research (Brown et al. 2000) has shown that heating prion infected tissues to 1000ºC for 5 minutes produced total inactivation of prions, destroying their ability to infect. The incinerator used by MDNR WDL reaches temperatures which substantially exceed 1000ºC.

5.1.1.1.2.2 C/P-OC. Issues regarding movement of carcasses of C/P-OC are likely to be similar to those related to free-ranging cervids, with the exception of carcass parts moving commercially, which would come under the authority of USDA and other federal agencies. In the audit of Michigan C/P-OC, less than 13% of the active facilities inspected reported shipping carcass parts (meat and antlers; Appendix B, Tables 15 and 17) out-of state, suggesting that relatively little risk of propagation of the disease would likely occur via out-of-state transport of carcass parts.

5.1.1.1.3 *Federal/state accreditation standards for CWD-free status*. In December 2003, the USDA's, Animal and Plant Health Inspection Service-Veterinary Services branch (APHIS-VS) initiated a proposal for a CWD Herd Certification Program and Interstate Movement of Captive Deer and Elk (http://www.cwd-info.org/docs/ProposedRuleAPHIS.doc). The plan states that participating deer and elk herds must follow program requirements for animal identification, testing, herd management, and movement of animals into and out of herds. After 5 years of enrollment with no evidence of CWD, a herd would be granted "certified" status. Owners of herds could enroll in a State program that USDA-APHIS-VS personnel have determined has requirements equivalent to the Federal program, or could enroll directly in the Federal program if no State program exists. The program also establishes interstate movement requirements to prevent the interstate movement of deer and elk that pose a risk of spreading CWD. The Federal program requires that cervids have 2 forms of identification, that all cervids 16 months or older that die on the facility be submitted for CWD testing, and restricts movement of live cervids.

The State of Michigan Department of Agriculture CWD Accreditation Plan (http://www.michigan.gov/mda/0,1607,7-125-1566_2310_13284-28120--,00.html) is a way for farms to certify that they have tested for CWD. The main difference between surveillance and accreditation is that accreditation has more record keeping requirements. Facilities that are buying and selling breeding stock are the most likely to use accreditation. Accreditation is a 5 year process. Facilities enrolled in the plan must:

- file an application with MDA;
- test 100% of death losses 16 months of age and older for CWD;
- have an accredited veterinarian submit samples to a lab approved by the state veterinarian;
- send copies of all CWD test results to the MDA AID;
- pay for cost of testing all deer or elk;
- meet record keeping requirements;
- meet animal identification requirements;
- meet fencing requirements; and
- adhere to restrictions on adding animals to the herd.

5.1.1.1.4 *Illegal movement of C/P-OCs*. Over the last 3 years, 733 cervids were purchased from out-of-state by all active facilities inspected. The borders have been closed to import of live cervids since April 2002. The audit questionnaire asked about animals imported from June 2001 to June 2004[5].

[5] This time period was designated because the question was intended to gather information on the general magnitude of recent importations, not specifically to assess compliance with the 2002 importation ban. This is consistent with the stated non-punitive nature of the audit.

Thirteen Ranch facilities brought in 540 (74%) of the cervids purchased from out-of-state, while 45 Full Registration facilities bought 190 (25.9%) cervids from out-of-state. Forty percent of cervids purchased out-of-state by active Class III and IV facilities were brought into the NW MU, suggesting a small number of facilities in the NW may be responsible for much of the out-of-state importations. If this is the case, the highest risk for CWD importation geographically may exist in the NW MU.

Because the goal of the audit was to determine any potential risk of CWD introduction into Michigan, both currently active and inactive facilities were assessed for importation. During some point of operation, 9% of Ranch facilities inspected imported animals from the CWD-positive states and provinces of AB, CO, MN, and WI, while 6% of Full Registration facilities imported animals from AB, IL, MN, SD, SK, and WI. MDA performed tracebacks and depopulated all animals which originated from a state that had CWD in C/P-OC. Most of the facilities that imported cervids from CWD positive states (21 of 36 or 58%) imported animals from WI. Importing animals from states where CWD has been documented in either C/P-OC or free-ranging cervids carries relatively higher risk than importation from other areas. However, because the minimum incubation period for CWD is estimated to be 15 months (Williams et al. 2002), an asymptomatic animal could be imported unknowingly even from areas not currently known to be affected. Although the amount of risk that is acceptable is clearly open to debate, there is no question that all importations carry some risk of CWD introduction unless the C/P-OC has tested negative for the disease prior to importation. To date there is no USDA-approved live animal test for CWD, although a live animal test for mule deer has seen limited use in field research (Wolfe et al. 2004).

Veterinary inspection certificates (VIC) must, by law, accompany live cervids being brought into Michigan, yet animals bought by 6 Full Registration facilities, 1 Ranch facility, and 1 Hobby facility did not have certificates (Appendix B, Table 16a). The VICs are one mechanism to help ensure that only healthy animals are being imported into the state. Importing animals that do not have health inspections prior to import likely increases the risk of importation of CWD and other diseases to both C/P-O and free-ranging cervids.

5.1.1.1.5 *Enforcement issues.* In order to monitor intra-state movements of cervids among 740 facilities statewide, agencies would need to develop a permitting and monitoring process. Even then, it would be difficult to ensure that all movements to and from all facilities have been documented.

Importation of live cervids from out-of-state has been illegal since April 2002. However, given the number of roads crossing state borders, detection of illegal importations at the border is a difficult task. As a result, enforcing the ban on interstate movement poses a formidable challenge for Michigan. Increasing the penalty for import, such as increasing fines, confiscating vehicles, or instating mandatory jail time, might make punishments sufficient to deter importation.

For this reason, it is critical that each C/P-OC facility keep complete and accurate records for monitoring movements of animals and regulatory agencies monitor those records on an ongoing basis. However, 20.7% of the Hobby facilities inspected did not keep adequate records, while 25% of Exhibition facilities, 12.8% of Ranch facilities, and 16.6% of Full Registration facilities kept poor records.

Accounting for all animals through unique identification is equally important to enable the effective monitoring of movements. All animals over 12 months of age in Full Registration, Exhibition, and Hobby facilities are required to have official identification and records of each individual, with ID, must be maintained on site. However, not all facilities had animals marked (Appendix B, Table 6a); 11% of the Full Registration

facilities did not mark all animals, while 13% of the Exhibition facilities and 40% of Hobby facilities did not identify all animals. Further, the AIA (1988) requires that all C/P-OC "bear official identification before they leave a premises," yet some facilities in each class (10%, 12.5%, 8.0% and 2.6% of Class I-IV facilities, respectively) reported having no identification on their C/P-OC prior to transport (Appendix B, Table 8a). While it is commendable that only relatively small percentages of C/P-OC facilities fail to adequately identify their animals in compliance with regulations, the fact that any such gaps in animal identification exist compromises enforcement of current regulations.

5.1.1.2 Intrastate movements

5.1.1.2.1 *Status of current regulatory requirements.* The OSRPOC (2000) requires records be maintained for all live animals moved into the facility, including age at entry into the herd, date and method of entry into the herd, and complete name, address, and phone number of the person from whom the animal was acquired. Facility owners must also keep copies of any test certificates, herd status letters, or official interstate or international health certificates required for compliance with any state or federal law, for all animals entering the herd. The sellers must retain the same paperwork. Animals added to the herd must also have official identification appropriate for the facility class. Act 190 (POCPMA 2000), states that anyone transporting a live cervid must produce documentation that contains the origin and destination of the shipment, copies of registration or permits, and all documentation required by the AIA. The AIA (1988) states that all live C/P-OC moving from one premises to another within MI must be officially identified with approved identification. Privately owned cervids moving from one premises to another in MI not under the same livestock operation, that are not going directly to slaughter, and are 6 months of age or older must:

- originate directly from a tuberculosis accredited, qualified, or monitored herd and receive an official negative TB test within 90 days of importation herd and be accompanied by a letter verifying herd status; or
- originate directly from a herd that has received an official negative tuberculosis test of all privately owned cervids 12 months of age or older and all cattle and goats 6 months of age or older in contact with the herd within 24 months before movement; or
- originate directly from a herd that has received an official negative tuberculosis test of all privately owned cervids 12 months of age or older and all cattle and goats 6 months of age or older in contact with the herd more than 24 months before movement, receive an official negative TB test within 90 days before movement, and be accompanied by copies of official tests; or
- be isolated from all other animals until receiving two official negative TB tests conducted not less than 90 days apart, with the first test being done not more than 120 days before movement.

Privately owned cervids less than 6 months of age moving from one premise to another in Michigan that are not going directly to slaughter must:

- originate directly from a tuberculosis accredited, qualified, or monitored herd and receive an official negative TB test within 90 days of importation and be accompanied by a letter verifying herd status; or
- originate directly from a herd that has received an official negative tuberculosis test of all privately owned cervids 12 months of age or older and all cattle and goats 6 months of age or older in contact with the herd within 24 months before movement; or

- originate directly from a herd that has received an official negative tuberculosis test of all privately owned cervids 12 months of age or older and all cattle and goats 6 months of age or older in contact with the herd more than 24 months before movement, be accompanied by an official permit for movement of privately owned cervids less than 6 months of age within Michigan or an official interstate health certificate issued by an accredited veterinarian, and remain at the destination stated on said documentation until it receives an official negative TB test when it becomes 6 months of age, but not more than 8 months of age.

C/P-OC that have TB test results other than negative or that are known to be affected with or exposed to TB are not eligible for intrastate movement without the permission of the Director of MDA.

5.1.1.2.2 *Illegal movements of C/P-OCs.* Regulations (OSRPOCF 2000) stipulate that Ranch facilities cannot legally remove live C/P-OC from the herd, yet audit inspections reported 82 live animals were moved out of Ranch facilities in the last 3 years.

All animals shipped do not necessarily require individual TB tests prior to shipping (depending on the characteristics of the herd of origin). All 6 Ranch facilities that shipped cervids within the state TB tested those C/P-OC prior to shipment, and 5 also had accompanying VICs, although as noted above, it is not legal to move live animals off of Ranch facilities. For Full Registration facilities, 86% of the 203 facilities that shipped instate reported having TB tested all animals prior to shipments, and 32% of the 203 had a VIC accompany shipped animals. These data suggest that most C/P-OC shipped instate are tested for TB.

Movement of C/P-OC from infected to uninfected facilities has caused CWD to spread among facilities in other states (Williams et al. 2002), and the presence of a large number of infected C/P-OC facilities in SK (44 as of October, 2004) relative to the number and location of positive free-ranging cervids suggests the frightening efficiency with which the disease can spread via the movements of infected C/P-OC. Based on information C/P-OC producers reported during the audit, MI Full Registration facilities moved 4,359 animals intrastate during the last 3 years, or about 1,400 per year (assuming approximately uniform movements over time, which may or may not have been the case). If CWD were introduced into MI, the movement of approximately 1,400 cervids around the state each year could expand the geographic area exposed to CWD dramatically, with the potential for spillover into free-ranging populations at each site. Given that the incubation period for CWD is at least 15 months, an infected cervid could be moved repeatedly for over 1 year before its sickness became obvious (Williams et al. 2002). The large number of animals moved intrastate could serve as a substantial risk for CWD propagation and geographic expansion if the disease is introduced into a C/P-OC facility.

5.1.1.2.3 *Enforcement issues.* Enforcement issues applicable to intrastate movement of C/P-OC are similar to those already discussed for interstate movements. In general, federal regulatory agencies are less involved in intrastate movements of livestock (with the exception of movements between areas with different TB accreditation status), and required records of C/P-OC movement and other regulations are less stringent than those for interstate shipment. Intrastate movements of an infected animal would be even more difficult to trace or control than those between states. Although C/P-OC producers would take steps to avoid spreading the disease from facility to facility once it is known to be present and MDA quarantines would help limit distribution, geographic propagation would remain a substantial risk as long as infected C/P-OC are asymptomatic.

5.1.1.3 Identification of individual animals

5.1.1.3.1 *Status of current regulatory requirements.* The OSRPOC (2000) states that all privately owned cervids should be visibly identified as privately owned. Cervids must be marked with an official alpha-numeric ear tag, tattoo, electronic identification, or other identification approved by the MDA Director, although tattoos and implanted electronic chips are not visible means of identification. Visible animal identification is not required if the facility has an adequate biosecurity plan approved by MDA, concurrent with DNR. MDA interpreted the biosecurity plan as fencing that meets fencing standards, thus all facilities were considered to have a biosecurity plan and were not required to have visible animal identification. All animals added to the herd by natural reproduction in Hobby, Exhibition, and Full Registration facilities (but not Ranches) must be identified by official identifications before 1 year of age. All animals brought into the facility must also be marked. The AIA (1988) also states that all privately owned cervids shall bear official identification before they leave the premises.

5.1.1.3.2 *Audit results.* Class I, II and IV facilities must have all animals over 12 months of age visibly identified, yet 37 Full Registration facilities (10.8%) did not mark all animals, while 1 (12.5%) Exhibition facility and 11 of 29 (37.9%) Hobby facilities inspected reported they did not mark all animals (Appendix B, Table 6a). Ranch facilities are not required to identify all animals, yet, commendably, over half of them reported that they did. Inadequately marked CWD-infected C/P-OCs that escape could quickly blend into the free-ranging cervid population, making recovery unlikely and hindering trace back of the animal to its facility of origin. An escaped, infected animal could interact with free-ranging cervids, acting as a potential source of CWD exposure until the animal either succumbed to the disease or was killed by some other means, such as harvest.

5.1.1.3.3 *Comparison of identification methods*. Current regulations allow considerable flexibility in how C/P-OC can legally be identified, as noted above in 5.1.1.3.1. Each method has comparative strengths and limitations. Alphanumeric ear tags are commonly used in livestock production and so are widely available and relatively inexpensive. Some, such as those used by USDA-APHIS-VS to identify animals tested for TB and vaccinated against Brucellosis have the distinct advantage of providing a unique identifier for the animal that distinguishes it from all others and ties it to a particular facility through USDA records. However, because of their relatively small size, such tags can be difficult to see. Consequently, distinguishing a cervid as C/P-O based on such tags requires the observer to be relatively close to the animal. Other ear tags, such as plastic bangle tags provide generally greater visibility at a distance but do not necessarily provide a unique identifier for a particular animal. In other words, many C/P-OC on many facilities may share the same colored, shaped, and numbered ear tag. A liability of all ear tags is that they can rip out of the animal's ear when caught on a fence, tree branch, etc. If such a tag was the animal's only identification, there would be no way to identify it as C/P-O thereafter.

Electronic identification holds a great deal of promise in some respects. Such identification uniquely identifies a particular animal, can be scanned without immobilizing the animal, and generally cannot be lost if implanted under the skin. Output data from readers of electronic identification are in a format that can be efficiently stored in electronic databases. However, electronic ID may need to be used in conjunction with some type of visible identification in order to distinguish an animal as C/P-O from a distance, and the relative newness of the technology makes it generally less available and more expensive than ear tags.

Although current regulations consider breed registration tattoos to be acceptable identification, tattoos cannot distinguish a cervid as C/P-O from a distance and cannot effectively be read without immobilizing the animal. Consequently, they are a relatively poor identification method for live animals.

5.1.2 *C/P-OC facility management*

5.1.2.1 Fence management

5.1.2.1.1 *Status of current regulatory requirements.* The OSRPOC (2000) states that all privately owned cervid facilities must have perimeter fencing constructed of continuous woven wire or cyclone fencing for the entire vertical height and be maintained in a condition to prevent the ingress or egress of any cervidae species. A facility owner or representative must inspect the perimeter fencing at least once per month and following any possible physical damage. The facility owner or representative must keep records of fence inspections and submit monthly fence inspection reports by January 15 of each year for the previous year. The fence's ground edge "shall remain at or below ground level at all times" (OSRPOCF 2000, p. 1), but openings up to 6 inches square can be present to facilitate movement of small mammals and reptiles.

Fence height requirements vary with species. For WTD, sika, fallow, and mule deer, fences must be 10 feet tall. For elk and red deer, fences must be 8 feet tall. Reindeer and caribou require 4.5 foot fences. Regardless of species, fences must "be maintained in a condition to prevent ingress or egress of any cervidae species" (OSRPOCF 2000, p. 1). Facilities that had 8 feet of woven wire with single stranded high-tensile wire as the top 2 feet of fencing, and were licensed for WTD by MDNR prior to April 1, 1998, were considered to be compliant with fence regulations. However, if sections of fence 40 feet and wider were replaced after April 1, 1998, the replacement fence must be 10 feet of woven wire. While the requirements are to prevent "ingress or egress of any cervid", free-ranging WTD, accomplished jumpers that they are, could nevertheless enter an elk facility with an legal 8 foot fence.

Gates must be constructed of continuous woven wire or cyclone fencing and meet or exceed fence height requirements for species contained in the enclosure. Gates must be adjusted seasonally, or more often if necessary, such that the bottom of the gate extends no higher than 8 inches from the ground along the entire length.

5.1.2.1.2 *Inspection.* Perimeter fences that house WTD must be 10 feet tall, and those for elk must be 8 feet tall. Yet, examining the minimum fence height reported by inspection teams (Appendix B, Tables 22a,b), nearly half of all facilities inspected were in non-compliance because of low fences; 46.5% of Full Registration, 49.6% of Ranches, 12.5% of Exhibition, and 41.4% of Hobby facilities had fences that were too low for the species housed at 1 or more points along the perimeter fence.

5.1.2.1.3 *Materials and construction.* Fence regulations state that continuous woven wire must be used for fences, but MDNR and MDA have generally deemed woven wire or materials stronger than woven wire acceptable for purposes of compliance. In general, woven wire is stronger than other fence types, and the regulations were written to prevent weaker type fences from being used to house cervids. Woven wire also allows better ingress and egress of smaller non-cervid species.

WTD are able to jump 8 feet fences with relative ease and are capable of clearing higher fences, if pressed. WTD can and do walk into and out of open gates or even relatively small gaps in fences. Risk of disease transmission from C/P-OC to free-ranging cervids or vice versa is increased dramatically when free-ranging deer gain access to enclosures (and subsequently escape from the enclosure) or when C/P-OC

escape from enclosures. While audit inspections found many facilities with exemplary fences (e.g., Figure 5.1), many other facilities either used unacceptable or poorly maintained materials (e.g. Figure 5.2) or did not meet minimum height requirements for the species housed (Figure 5.3). Others never repaired storm damage that compromised the integrity of the fence (sometimes completely, e.g. Figure 5.4), had gaps in (Figure 5.5) or under (Figure 5.6) fences which easily allowed deer to pass through in either direction, or had gates which were out of compliance (Figure 5.7). All of these problems increase potential CWD risk to both C/P-OC and free-ranging cervids.

Fence faults did not vary dramatically by class. Facilities averaged approximately 0.5 to 2 faults per facility. A graph of fence faults normalized to faults per mile of fence is presented in Appendix B, Figure 8. Viewed by this measure, the majority of C/P-OC facilities of all classes had no fence faults/mile of fence. However, some facilities, particularly in the Full Registration class, had substantial numbers of fence faults per mile. For example, more than 50 Class IV facilities had up to 5 faults per mile, about 20 had 5 to 10 faults per mile, etc. Inspectors found at least 1 Full Registration facility with more than 100 faults per mile of fence. Defects in fences are often quickly found and exploited, especially by deer, and every fence fault carries a risk of mixing between the C/P-O and free-ranging cervid populations and a risk of disease introduction from one population to the other.

5.1.2.1.4 *Maintenance.* Current regulations require that fences be inspected monthly for faults. Commendably, nearly all active facilities, 97%, responded that fences were inspected monthly. For active Full Registration and Ranch facilities, 97% were inspected monthly. Fences were reportedly inspected monthly on all Hobby facilities and on 75% of inspected Exhibition facilities. The adequacy of monthly fence inspections depends on the habitat immediately adjacent to the fence. In forested areas, one intense windstorm can cause major fence faults at any time. The OSRPOCF (2000, p. 1) specify that the integrity of fencing needs to be monitored "following any possible physical damage," which is particularly difficult for large facilities with extensive perimeter fences to maintain. Inspection comments suggest that some facilities inspect fences more than once a month. However, the 3% of facilities that do not inspect fences at least monthly present an increased risk of disease introduction to free-ranging wildlife should they happen to house infected individuals.

5.1.2.1.5 *Contact with free-ranging cervids*. The majority of C/P-OC in Michigan could make contact with free-ranging cervids at fence lines. Of active Ranch and Full Registration facilities, 94% had potential contact with free-ranging cervids. It has been demonstrated that pens contaminated with feces or carcasses of infected cervids are infective for naïve animals (Miller et al. 2004). It seems likely that saliva is infective as well, given transmission by direct animal to animal contact in experimental studies (Miller and Williams 2003). The possibility exists for CWD exposure through a fence, either from free-ranging deer to C/P-OC or from C/P-OC to free-ranging animals, but the risk is likely lower than that entailed by direct mixing of animals.

Figure 5.1 Examples of excellent fences found at some C/P-OC facilities inspected during the audit. Note vehicle gates (upper left), human passage gates (upper right) and stream crossings (lower left) maintained with no gaps which would allow ingress or egress of cervids, and fence material extending along the ground at the bottom to prevent cervids from going under (lower right).

Figure 5.2. Unacceptable or poorly maintained fences found during audit inspections. Clockwise from upper left: chicken wire fencing, broken wooden posts, and a cobbled together slab wood fence.

Figure 5.3. Examples of fences found to be too short for the species housed (deer in both cases) during audit inspections.

Figure 5.4. Examples of fences compromised by storm damage and never repaired that were found during audit inspections.

Figure 5.5. Examples of defects in fences that were documented during audit inspections.

Figure 5.6. Examples of defects under fences that were documented during audit inspections. Note the evidence of animals having moved under the fence in the bottom photo.

Figure 5.7. Non-compliant gates found during audit inspections. Note the gaps between the gates (top) and between the gate and the fence (bottom) through which a deer could easily pass.

Free-ranging cervids were reported to have been found inside enclosures in 3.8% of Full Registration facilities and in 20.0% of Ranch facilities. Only 1 Exhibition facility, reported that free-ranging cervids had been found in the enclosure. If free-ranging cervids can get into the facility, they can likely leave it as well. To the extent that is true, free-ranging animals exposed to C/P-OC can potentially carry infection outside of the facility and infect other wild cervids. Similarly, free-ranging deer can potentially expose C/P-OC to pathogens.

5.1.2.1.6 *Escapes and recovery protocol.* The OSRPOCF (2000) states that all livestock within the perimeter fence that become located outside the perimeter fence, not under the direct control of the owner for more than 12 hours, will be considered as released. The owner then must report the release within 24 hours of discovery, although outside of normal business hours the owner is allowed to delay the report until the next business day. Consequently, if an escape occurred on Friday evening, over 2 days could elapse before the facility is legally required to report the escape. Animals that are released and then recovered must immediately be placed in an isolation facility that maintains the recovered animals no less than 30 feet from the remainder of the herd. If the animal is not recovered within 48 hours after being discovered as released, MDA will implement a recovery plan. In this plan, MDA is responsible for determining the maximum allowable timeframe for recovery. MDA will also evaluate the cause of the release and may require modifications to fences or facility management practices to prevent further releases. The OSRPOCF specifies that released animals will remain privately owned cervids as long as official identification remains intact and the owner follows MDA procedures for recovery. However, the POCPMA (2000, p. 9) also notes that "an animal that escapes from a facility is considered to be public property if the operator of a cervidae livestock facility does not notify the department (MDA)." Animals that are released and do not bear official identification are not exempted from legal taking under a MDNR permit (e.g., by licensed hunters).

Over the course of audit inspections, C/P-OC representatives reported that during the last 4 years, 464 cervids had escaped from 69 (20%) active Full Registration and 18 (14.4%) Ranch facilities, with 87.9% (408) of those reported escaped animals being from Class IV facilities (Appendix B, Table 9a). However, data obtained from MDA on May 17, 2004 record only 8 reports of released cervids in the last 4 years, less than 2% of all escapes reported by facilities during audit inspections. It is possible that some of these escapes were not reported to MDA because they were recovered before 12 hours elapsed. Other evidence independent of the audit also shows not only that escapes of C/P-OC occur, but that they often go unreported. Each year, escaped C/P-OC turn up among samples of hunter-harvested free-ranging deer submitted for TB and CWD testing (e.g., Figures 5.8, 5.9).

The higher proportion of escapes from Full Registration facilities may in part be due to greater awareness of inventory or may be attributable to more intensive management and better record keeping. While it is possible that escapes actually occurred more often on Class IV facilities, it is also conceivable that Ranch facilities experienced escapes which simply went unnoticed due to larger average facility size. In addition, Ranch facilities are not required to mark all animals on the premises, so it is more difficult to determine if cervids outside the enclosure are free-ranging or escaped captives. Twenty percent of inspected Hobby facilities reported to audit inspectors that escapes had occurred, as did 25% of Exhibition facilities. The most common species to escape (consistent with their predominance among all MI C/P-OC) were WTD and elk, both of which are susceptible to CWD. However, non-native species were also reported escaped. Fence faults and gates left open accounted for many of the escapes (Appendix

B, Table 10a). Cervids were reportedly tagged prior to escape on 50% of the Ranches, 81% of Full Registration facilities, 67% of Hobby facilities, and on 50% of Exhibition facilities where cervid escapes were reported. Most facilities used USDA metal eartags or other visible eartags for identification prior to escape. WTD (and elk, in areas of the state where free-ranging elk are present) that bear no identification can quickly blend into the free-ranging population, making recovery and return to captivity much more difficult and transmission of any diseases they may carry much more likely.

Reported recovery rates of escaped C/P-OC were variable among facility classes (Appendix B, Table 9a), but at least 41 escaped animals (8.8%) were never recovered. CWD-infected C/P-OC have been implicated as sources of infection for free-ranging cervids in NE, SD, and SK (Williams et al. 2002), and CWD-infected escaped C/P-O WTD have been documented at large with free-ranging WTD in WI (Joly et al. 2003). Even if subsequently recovered, CWD-infected escaped C/P-OC could potentially act as a source of infection for numerous free-ranging cervids, based on research suggesting that feces from CWD-infected deer are infectious for uninfected deer (Miller et al. 2004). In areas of Michigan where concentrations of C/P-OC facilities as well as relatively high WTD densities (Appendix C, Figure 3) occur, the risks for propagation of CWD among free-ranging deer could be expected to be high once infected.

Three Full Registration facilities and 1 Ranch facility reported intentionally releasing C/P-O WTD into the wild (Appendix B, Tables 11a,b). Intentional release of C/P-OC is a felony in MI (POCPMA 2000, Section 17). The audit data suggest that intentional releases are infrequent, although given the penalties, the numbers noted here, which are based on C/P-OC facility self reports, may be an underestimate.

5.1.2.2 Record keeping

5.1.2.2.1 *Status of current regulatory requirements.* The OSRPOCF (2000) require that farm records must be kept on site for all species kept within the herd, and all animals within the perimeter fence are considered part of the herd. Facility owners must identify a record-keeping system to receive a registration for their facility. Also, the owner of each captive cervid facility must submit an annual report to MDA, including inventory and the perimeter fence inspection. Records on the following are mandatory for each livestock animal within the herd:

1. official identification number;
2. species and gender;
3. age upon entry into the herd;
4. date and method of entry into the herd, including purchase or natural reproduction;
5. for any purchased animals, the complete name, address, and phone number of the person from whom the animal was acquired;
6. copies of any test certificates, herd status letters, or official interstate or international health certificates required to show compliance with state and federal laws, for all animals entering the herd;
7. date and method of disposition for any animals removed from the herd, including sale, mortality, or transfer;
8. for animals sold or transferred live, the complete name, address, and phone number of the person who received the animals at the destination; and
9. copies of any required test certificates, herd status letters, or official interstate or international health certificates required to show compliance with state or federal laws for animals removed from the herd.

Figure 5.8. Example of a C/P-O WTD found by MDNR in a sample of hunter-harvested deer submitted for TB and CWD testing. The doe's USDA TB testing ear tag (bottom photo, partially obscured to protect the identity of the producer) was used to trace the animal to its facility of origin. Cross reference with data obtained from MDA shows that this deer's escape was not reported by the owner. The facility owner did report the animal as having escaped to MDNR inspectors during the audit.

Figure 5.9. An example of a non-native C/P-O deer harvested in the wild by a licensed hunter and brought to an MDNR deer check station.

The POCPMA (2000) states that persons engaging in a cervidae livestock operation must be registered with the Department of Agriculture. All persons registered as cervidae livestock operators must keep records on production, purchases, or imports in order to establish proof of ownership. In addition, persons transporting cervids must keep documentation containing origin of shipment, registration or permit copies, destination information, and all other documentation required under the AIA (1988). It is illegal for a person to knowingly provide false information in matters pertaining to POCPMA, such as records.

5.1.2.2.2 *Inspection results*. Two Full Registration facilities reported having altered their records, thereby knowingly providing false information to MDA (Appendix B, Table 23a,b). One Full Registration and 1 Hobby facility reported having no records, despite the explicit necessity of record keeping in both POCPMA and the OSRPOCF.

The inspection report sheet asked audit inspectors to determine if overall facility records and fence inspection records were satisfactory. For the sample of audited Hobby facilities, over 20% did not keep adequate overall records, and over 30% did not keep adequate fence inspection records. Similarly, 25% of Exhibition facilities had inadequate overall records, and 13% had inadequate fence records. Of 344 Full Registration facilities, over 15% did not have adequate overall or fence inspection records, and over 10% of the Ranch facilities did not keep adequate overall or fence inspection records. The majority of C/P-OC facilities inspected did maintain adequate and, in some cases exemplary, records. Nonetheless, for those that did not, it is difficult to determine if their

facilities are complying with regulations that require good documentation, such as those regarding importation of C/P-OC, disease testing, animal identification, and fence maintenance. In addition, if CWD were ever introduced to Michigan, inadequate records would greatly hamper further surveillance and control efforts, thereby greatly increasing the probability of disease propagation.

5.1.2.3 CWD testing

5.1.2.3.1 *Status of current regulatory requirements.* On September 1, 2002, the MDA initiated a mandatory CWD surveillance program for C/P-OC facilities (MDA 2002). Regulations require that all deer and elk death losses (culls, those euthanized due to illness, or found dead) 16 months of age and older be tested for CWD. If a facility is doing a normal cull of a large number of animals, a representative sample is required to be tested (N. Frank, MDA-AID, personal communication). MDA must send results of all tests to the submitting facility.

5.1.2.3.2 *Expected numbers based on mortality records*. During the course of MDNR audits, facilities reported that 17,527 cervids had died in active Full Registration and Ranch facilities statewide over the last 4 years, and 1,962 (11.2%) of them were tested for CWD (Appendix B, Table 12a). This facility-reported number is close to the number of CWD tests recorded (2,085) in MDA data as of May 17, 2004. Ranch facilities reported that 12,530 animals died and 1,068 (8.5%) were tested while Full Registration facilities reported 4,997 deaths and tested 894 (17.9%). Because mandatory testing regulations have been in place for a little over 2 years but the questionnaire covered 4 years, it is not possible to determine the exact time distribution of CWD tests during the period. However, all the CWD test records in MDA's database are dated after January 2002, so it is reasonable to assume that most of the facility-reported tests have occurred in the last 2 years. In spite of the fact that testing of all cervids 16 months and older is mandatory according to the MDA surveillance program, the numbers of C/P-OC tested clearly fall far below the numbers of animals reported by facility representatives as having died. Only 23 of 2,085 (1.1%) cervids in MDA's CWD testing data base were aged less than 16 months, so young age at time of death is unlikely to account for the conspicuous lack of testing.

Sample submission varied with facility, and some facilities have sent in adequate samples, while others have not submitted any samples for CWD testing at all (Appendix B, Figure 6). Between 40 - 50% of the Class III and IV C/P-OC facilities reported having tested none of their cervid deaths for CWD, while less than 10% of these classes tested =10% of their eligible deaths. These facility classes were responsible for virtually all of the C/P-OC imported from out-of-state, including areas where CWD is known to be present.

It is clear from these data that most C/P-OC facilities do not fully comply with CWD testing regulations. Although CWD testing is mandatory, nearly 90% of C/P-OC deaths reported in the audit were not tested. The significance of this from the standpoint of disease risk cannot be overstated. Without adequate testing, the introduction of CWD into Michigan's C/P-OC cannot be detected. More importantly, the possibility cannot be ruled out that the disease has already entered Michigan and is currently propagating undetected. The lack of CWD testing was one of the two greatest risks documented by the MDNR audit.

5.1.2.4 Waste disposal

5.1.2.4.1 *Status of current regulatory requirements.* The MDA Regulations for Act 239, as amended, Bodies of Dead Animals (BODA 1982) regulate the disposal of animal

carcasses, including livestock. The provisions of BODA primarily concern placement of individual and common graves in relation to ground and surface water, regulation of carcass transporters and renderers, and specifications for composting of carcasses. Notably, the act does not address accessibility of disposed carcasses to other livestock or free-ranging wildlife. The POCPMA (2000) defines C/P-OC as livestock, making them subject to compliance with BODA. The OSRPOCF (2000) states that the dates and method of disposition for animals removed from the herd, including sale, transfer, or mortality, must be recorded. Mortality records must include whether the mortality was intentional or non-intentional and method and site of disposal. Records must be kept for 3 years following the animal's removal. We were not able to find any other state regulations on carcass disposal for C/P-OC.

5.1.2.4.2 *Dead animals/offal.* About half of Ranch facilities buried carcasses >3 feet deep[6] (49.6%) and the majority disposed of carcasses within the enclosure (68.8%) (Appendix B, Tables 13a and 14a). However, 24% of Ranch facilities left carcasses above ground, potentially exposing enclosed cervids and scavenger species to any diseases carried by the dead animals. Full Registration facilities primarily buried carcasses >3 feet deep (58.4%) and disposed of them outside the enclosure (59.6%), but 8.1% of the Full Registration facilities left carcasses above ground, potentially exposing free-ranging cervids and scavenger species to pathogens in the carcasses. Another 71 facilities (20.6%) reported burying carcasses <3 feet deep, a depth at which scavengers could potentially unearth the remains. Eighty-six percent of audited Hobby facilities also disposed of carcasses outside the enclosure, and 5% left carcasses above ground. At least in theory, above ground disposal scenarios could create a CWD transmission risk for cervids in Michigan. Miller et al. (2004) documented the occurrence of indirect transmission of CWD via paddocks contaminated by the carcasses of infected mule deer left to decompose above ground. Carcasses disposed of above ground outside C/P-OC enclosures could expose free-ranging cervids to CWD or other pathogens, whereas those inside enclosures could propagate CWD among C/P-OC. Free-ranging cervids could potentially be exposed to C/P-OC carcasses disposed of in shallow graves if scavengers excavated them and scattered parts above ground. However, burial in graves <3 feet deep is not necessarily illegal. BODA (1982, Rule 2) specifies that common graves must have a final covering of at least 2 feet of soil. BODA does not appear to specify the depth of final soil cover for individual graves.

5.1.2.4.3 *Manure*. Miller et al. (2004) also investigated whether excreta from CWD-positive mule deer were infective for naïve cervids. They found that environments contaminated with excreta from infected mule deer were infective to naïve mule deer 2.2 years after the infected animals were removed. Most C/P-OC facilities do not systematically dispose of cervid feces and urine, which typically decompose within pens where cervids are kept. This could potentially create a risk to other C/P-OC in the herd if a CWD-infected animal was unknowingly introduced into the herd. Research to date (Sigurdson et al. 1999; Williams and Miller 2002; Miller and Williams 2003) suggests feces are the likely component of the excreta that is responsible for shedding of CWD prions.

[6] Audit questions concerning carcass disposal were deliberately phrased to address depths that were considered reasonably inaccessible to livestock and free-ranging wildlife above ground, not to assess compliance with existing MDA carcass disposal regulations. This is consistent with the stated non-punitive nature of the audit.

5.1.2.5 Facility closure (procedures for leaving the business)

5.1.2.5.1 *Status of current regulatory requirements.* Currently, no specific regulations on de-commissioning C/P-OC facilities exist in the OSRPOCF, the AIA, or the POCPMA (2000), other than Section 17(2) of the latter which specifies that "an owner shall not abandon a registered cervidae livestock facility without first notifying the department (i.e. MDA) in compliance with the standards established under this act." Yet, no standards have specifically been established. Such abandonment is declared to be a felony, but no other guidance on closing the facility is given. Due to this lack of regulations, current interim practice since June 15, 2004 is to have MDNR personnel inspect the facility to ensure that all C/P-OC have been eliminated from the premises once written notification of the desire to decommission is received. Once MDNR verifies depopulation, the agency informs the facility owner of the fence regulations in NREPA (1994b). Facility fences must be maintained to exclude cervids and/or be modified so that they do not compromise the movement of free-ranging wildlife.

5.1.2.5.2 *Disposition of animals*. According to the current interim practice, C/P-OC owners wishing to de-commission must harvest all remaining animals (the only option for Class I, II and III facilities) or sell and transport cervids off the property (for Class IV facilities only) prior to facility closure. The rules governing the transport, movement, and disposition of C/P-OC covered in the OSRPOCF, the AIA, and the POCPMA apply. Therefore, TB testing requirements, animal identification, and record keeping must comply. However, such restrictions may be impractical for individuals who become emotionally attached to their animals; such individuals may intentionally release their C/P-OC into the wild to avoid having to kill them.

5.1.2.5.3 *Fence modifications following decommissioning*. Fences >52 inches in height and >¼ mile in length must be modified so that passages are added for free-ranging wildlife (NREPA 1994b). Passages are spaces, openings, or fences <52 inches in height constructed in a manner to ensure the passage of wild, free-ranging deer, elk, bear, or moose. For a passage to be constructed in a manner to ensure the movement of wild, free ranging deer, elk, bear, or moose, passages shall be at least 40 feet wide and shall be spaced no more than 660 feet from the next passage, and fence corners shall have passages extending at least 20 feet in each direction. These passages would permit the entrance of free-ranging deer and elk into enclosures once used by C/P-OC. As noted previously, given that CWD can be transmitted by environmental contamination (Miller et al. 2004), these enclosures could expose free-ranging deer to CWD if a CWD-infected C/P-OC had been enclosed there. As a result, modifying fences for passage of free-ranging wildlife could be unwise. This becomes problematic because C/P-OC facility owners may be unaware of exposure and disease status of their animals, and because most MI C/P-OC facilities have not adequately tested for CWD (Appendix B, Figure 6).

5.1.2.5.4 *Future land use*. If a facility that housed a CWD-positive cervid becomes de-commissioned, the land could not be used for another C/P-OC facility without running the risk of re-infection. Moreover, free-ranging animals should not be allowed access to the site, because transmission of CWD via contaminated enclosures has been documented in both research (Miller et al. 2004) and field settings.

5.1.2.5.5 *Regulatory monitoring*. Oversight of the de-commissioning process is likely to be time-consuming. Inspection teams found that 35 C/P-OC facilities were no longer actively operating (Appendix C, Figure 2). These facility owners did not know the protocol for becoming de-commissioned. This is not surprising, given that no such

protocol is specified in the MDA regulations applicable to C/P-OC. The current interim MDNR practice arose *ad hoc* as a result of these facilities, but clearly a more formal and widely-communicated decommissioning protocol, based in the Michigan Code of Laws, is needed. Lacking such a protocol and the enforcement of it, the risk of facility owners releasing their C/P-OC into the wild and abandoning their facilities remains real. Risks of CWD introduction following such releases have been discussed above in the section regarding escapes.

5.1.2.5.6 *Liability*. If CWD is introduced into free-ranging cervids by contaminated C/P-OC enclosures or if infected C/P-OC are released because of poor oversight of facility decommissioning, the subsequent CWD control effort could be expensive. For example, a Wisconsin Legislative Audit Bureau Report dated October 21, 2003 documented that in less than 2 years, the State of WI spent $14.7 million on surveillance and control of CWD. Twelve million dollars went towards CWD-testing of free-ranging cervids by WI DNR.

5.1.2.6 Feed

5.1.2.6.1 *Status of current regulatory requirements.* Currently, no regulations on feed products at C/P-OC facilities are present in POCPMA or the OSRPOCF, and the AIA (1988) only provides specific regulations for feeding swine. Although the feeding of ruminant by-products back to ruminants is regulated by USDA, we were not able to find any other State regulations regarding feed for C/P-OC.

5.1.2.6.2 *Composition*. Of the active Ranch facilities, 95% fed dietary supplements, and 98% of Full Registration facilities fed supplements. Pelleted diets, grain, and produce were most commonly fed. Unlike BSE, CWD is not a food-borne disease spread through feeding rendered meat and bone meal, but infected brain material fed to captive WTD and elk has been infective (Williams et al. 2002). However, mouse strain typing has shown that the prion causing CWD differs from those causing scrapie and BSE (Williams and Miller, 2002). As a result, introduction of CWD through feed imported into MI is not considered to be a risk based on current research.

CWD is a contagious disease, however, and concentrating animals at human provided feed sources increases the potential for transmission of a variety of contagious diseases of cervids including bovine TB (de Lisle et al. 2002) and Brucellosis (Godfroid 2002). If CWD is introduced into a MI C/P-OC facility, the commonplace practice of feeding supplements would likely pose a substantial risk for amplification of the disease within that herd. Concentrating animals has been suggested as a risk factor for high transmission rates, contributing to high prevalence of CWD on C/P-OC facilities in some affected states (Williams and Miller 2002).

5.1.2.6.3 *Management.* Free-ranging cervids with access to feed in C/P-OC facilities could come into indirect contact with potentially CWD-infected C/P-OC, or vice versa. Because of this, feeds for C/P-OC need to be managed in such a way that free-ranging wildlife are prevented from accessing them. Saliva and feces are the most likely means of transmission of CWD (Sigurdson et al. 1999; Miller and Williams 2003), and contamination of feed with either carries a risk of CWD transmission.

5.1.2.7 Biosecurity (machinery, trailers, personnel moving in and out of facility)

5.1.2.7.1 *Status of current regulatory requirements.* Currently, the OSRPOCF (2000) does not address any specific regulations regarding biosecurity procedures at C/P-OC facilities, but the standards do state that MDA will conduct inspections of each registered

facility at least every 3 years. Inspections will be conducted on a risk basis, using criteria which may include type of registration approved, difficulty of complying with requirements, risk of release of animals, size of facility, number of animal movements reported, disease risk, and history of complaints, inspections, and compliance. Biosecurity issues could be considered relevant to such inspections. The OSRPOCF also states that all facilities that apply for registration must submit a business plan that includes a discussion of biosecurity measures to be used, including, but not limited to, methods of fencing and appropriate animal identification and record-keeping system employed. Lastly, the AIA (1988) states that the MDA can develop, implement, and enforce scientifically based movement restrictions and requirements including: bovine TB test requirements; prior movement permits; official intrastate health certificates or animal movement certificates to accompany movements of animals; and official identification of animals for movement between or within a disease free zone, surveillance zone, an infected zone, or any combination of these zones. These could be considered relevant to moving equipment, trailers, etc. as well as individual C/P-OC.

5.1.2.7.2 *Exposure of other C/P-OC facilities or free-ranging wildlife via equipment.* Although much remains to be learned about CWD transmission, current research suggests that the disease is primarily transmitted horizontally, i.e. from animal to animal (Miller and Williams 2003). However, other recent research (Miller et al. 2004) has shown that deer can become infected from contaminated environments. The prion which causes CWD is extremely resistant to degradation in the environment (Brown et al. 2000; Williams et al. 2002). As a result, concern about transmission of prions on contaminated equipment has been raised. To date, transmission from contaminated equipment has not been documented (Dr. E. S. Williams, University of Wyoming, personal communication, 11/9/04), thus this route of transmission appears to hold little risk, at least at present. However, as a precaution, when wildlife health personnel in Wyoming travel from CWD-infected research facilities to the National Elk Refuge or other uninfected sites, they do not use trucks, trailers, and other equipment that has been used on the infected facility (H. Edwards, Wyoming Game and Fish Department, personal communication, 11/3/04). Given the potential consequences, such biosecurity precautions seem prudent, even if they ultimately prove to have been unnecessary.

5.1.2.8 Co-mingling of species

5.1.2.8.1 *Status of current regulatory requirements.* POCPMA and the OSRPOCF do not currently contain specific regulations concerning co-mingling of cervid species. The AIA only provides regulations for co-mingling animals exhibited at fairs. We were not able to find any other regulations on co-mingling of species relevant to C/P-OC.

5.1.2.8.2 *CWD susceptibility*. White-tailed deer, mule deer, and elk are the only species known to be naturally susceptible to CWD (Williams et al. 2002). Because red deer are the Old World subspecies most closely related to elk, it is prudent to assume that they are likely also susceptible to CWD. Numerous facilities in Michigan co-mingled susceptible species. For active Ranch facilities, 40% co-mingled species and among those 82% co-mingled susceptible species. A smaller percentage of Full Registration facilities, approximately 12%, co-mingled cervids, and a smaller number of those facilities (39%) co-mingled susceptible species. Co-mingling species susceptible to CWD increases the pool of animals that could serve as a reservoir of infection for a herd. Also, susceptible species that are co-mingled in the same facility (say, WTD co-mingled with infected elk) could theoretically facilitate transmission to surrounding free-ranging deer, if the C/P-O deer are more likely to escape the enclosure and blend into the surrounding population

than the elk are. Many facilities acquire different species from different farms, increasing the geographic area over which the C/P-OC originate.

5.1.2.8.3 *Effects on fence integrity*. Several facilities had many species subject to hunter harvest mixed together in large pens. For instance, a hunting Ranch could have wild boars, elk, fallow deer, and WTD in the same large enclosure. Boars will dig under fences, compromising the integrity of the fence for all species housed inside the enclosure and raising the risk of escapes for C/P-OC housed with them. Most inspected C/P-OC facility representatives had wisely reinforced the bottom of fences to deter boars digging. Still, increasing the number of species housed together can potentially increase fence faults and the frequency with which fence maintenance must be carried out.

5.1.2.8.4 *Domestic animals/disease ecology*. Some diseases, such as bovine TB, are able to infect numerous wildlife and domestic species, including humans. Housing multiple species together potentially provides an opportunity for pathogens to adapt and cross over into previously unaffected species. Diseases typically evolve to infect a particular or a few host species but can jump into other species, if circumstances allow for transmission. A disease can be transmitted to a new species when the naïve species is placed into a new ecosystem where the disease has evolved with its traditional hosts or placed in contact with infected individuals (Thrusfield 1995). Co-mingling species provides an opportunity for naïve species and individuals to be exposed to new pathogens.

It has been suggested that CWD originated when susceptible cervids came in contact with a strain of the sheep scrapie prion that acquired the ability to cross the species barrier. The apparent transmission of BSE to humans and other mammals emphasizes the possibility for such cross-species transmission among other TSEs (Raymond et al. 2000). While co-mingling of species provides the opportunity for transmission of CWD to novel species, there is little research evidence at this time to suggest this is a likely to be a risk.

5.1.3 *Agency implementation of Act 190*

5.1.3.1 Facility standards

5.1.3.1.1 *Fence height.* The OSRPOCF (2000) provide sometimes conflicting regulations concerning fence height for C/P-OC facilities. For example, on the one hand, the standards give species-specific measures, yet they also specify that perimeter fencing must "be maintained in a condition to prevent ingress or egress of any cervidae species." In the case of deer (10 feet height requirement) the 2 regulations are consistent. In the case of elk and caribou (which have 8 feet and 4.5 feet fence height requirements, respectively), the stated minimum fence heights are insufficient to prevent the ingress of free-ranging WTD. This conflict in the implementation of the POCPMA creates the potential risk of CWD introduction into the free-ranging deer population, if free-ranging WTD were able to move in and out of an enclosure containing C/P-O elk infected with CWD. Conversely, if the wild population was CWD-infected and the C/P-O elk were not, a risk would be present for the elk. Since reindeer are not currently known to be susceptible to CWD, this issue entails less risk for that species. However, the ease with which free-ranging WTD move over a 4.5 foot fence could entail some risk for introduction of other diseases, such as TB. A standard minimum fence height of 10 feet for all C/P-OC facilities would be one possible means of addressing this risk.

5.1.3.1.2 *Fence composition/construction.* The OSRPOCF (2000) and POCPMA (2000) specify that C/P-OC facility fences be constructed of continuous woven wire. If these regulations were interpreted strictly, no other fence material would be considered in

compliance, yet audit inspections found a number of facilities used various combinations of other materials. The inspectors judged some of these materials to be sufficient to provide the necessary barrier between the C/P-O and free-ranging cervid populations (e.g., 12 feet high chain link fences or 12 feet high wooden plank walls), while others were not (e.g., the cobbled together slab wood fence in Figure 5.2). Examination of the MDA registration data base and comments from audit inspectors suggest that the ultimate standard of what fence materials were in compliance was subjective. Such subjectivity would ideally be replaced by an explicitly stated, more uniform standard of what an acceptable fence is. A uniform standard would give C/P-OC producers a more straightforward expectation of compliance requirements and minimize the potential disease risks arising from subjective judgments of fence adequacy.

5.4.3.1.3 *Gate standards*. The OSRPOCF (2000) and POCPMA (2000) specify that the bottom of C/P-OC facility gates must extend no more than 8 inches above the ground. While likely adequate to prevent movement of adult cervids underneath the gate, such a gap could allow a fawn to crawl through. Consequently, the same conflicting regulations discussed above under fence height apply here as well. Fawns are typically not likely to be a high risk for CWD introduction, although infected fawns have been documented (Williams et al. 2002). Revising the fencing standards to lower the bottom edge of a gate to an impassable level would be one possible way of addressing this issue. However, accommodating the movements of small, free-ranging animals while also preventing escape of fawns could prove challenging. Issues discussed directly above under fence composition/construction are also relevant to gates.

5.1.3.2 Facility records

5.1.3.2.1 *Format requirements/database issues*: Both the OSRPOCF (2000) and POCPMA (2000) require that C/P-OC facilities keep a variety of records, but they give little specific guidance with respect to format. MDNR examination of MDA facility files prior to conducting the audit disclosed a great deal of variation in the methods C/P-OC facilities used to keep records and variation in quantity and quality. Some records were excellent and comprehensive, while others were poor or non-existent. Issues regarding the potential CWD introduction risks entailed when facilities do not maintain adequate records have already been discussed at length in Section 5.1.2, but some potential risk also arises from the aspects of records other than just whether or not they are maintained in compliance with current standards.

Inconsistencies in the methods of record keeping lead to problems in accessibility that make CWD surveillance difficult and could prove costly in the event of a CWD outbreak. For example, paper records are of limited value for disease surveillance and compliance issues because they are of variable quality, easily damaged or misplaced, and usually maintained in only 1 or 2 locations. In the event records are needed to deal with a CWD control effort, multiple individuals with critical roles in control (e.g., epidemiologists and veterinarians with both state and federal agencies, law enforcement personnel, public health officials, industry groups, etc.) may all need access to the same information at the same time. In this case, electronic records maintained in a central database that disease control staff, compliance and enforcement agencies, and the C/P-OC facility can all access simultaneously would have distinct advantages.

In addition, electronic databases can be designed in such a way that the format of the records themselves is consistent and contains all critical information, rather than relying on each C/P-OC producer or a variety of different agency personnel to subjectively determine which information to include and which not. Carefully designed databases can ensure that related information on the same facility or animal stored in

several different places is compatible and quickly accessible. One example relevant to this audit could be drawn from the C/P-OC facility databases MDNR obtained from MDA. MDA kept information on herd inventories, TB testing, CWD testing, and compliance investigations in separate databases employing separate formats, some of which were incompatible with each other in critical ways. CWD test results were recorded in the name of the person who submitted the test rather than by the unique C/P-OC facility number. Consequently, the tested animal could only be traced to its herd of origin via a separate database (for animals identified by USDA TB testing ear tags), or in some cases, not at all. Without knowing the herd of origin, a positive CWD test result could not reliably or easily be traced to a particular location, delaying or preventing further testing and control efforts. To use another example, C/P-OC annual inventory reports are in a format which records only summary tallies of the total number of animals born, removed, etc., and not the identification information for individual cervids. This data format makes it impossible to determine the current whereabouts of a particular animal without consulting the producer or some other data base. Such inefficiencies can cost valuable time in the event of a disease outbreak and can easily be minimized by good data base design and uniform requirements for record keeping that are vigorously enforced. Finally, MDA's apparent practice of issuing registration ID numbers to facilities before the facilities had actually completed the registration process and been issued final registration should be revisited. Comments from the audit inspections make clear that many C/P-OC facilities were completely unaware that their facilities were technically unregistered and that they should have received a hard copy registration from MDA.

5.1.3.2.2 *Spatial data*. One aspect of record keeping that is not required under current regulations, but that could be of critical use in the event of a CWD introduction, is the gathering of spatial data for C/P-OC facilities. The use of GPS data gathered by auditors to create site maps (e.g., Appendix A, Exhibit 7) has already been discussed. Such data, if rigorously collected and maintained, can be used to monitor modifications to the facility, adjacent land use, habitat types in the areas surrounding the facility, etc. Such factors could prove critical in CWD control situations where location of an escaped C/P-OC was required or where culling and CWD testing of a sample of free-ranging deer from around the facility is required (e.g., in the event a C/POC facility tests CWD positive) to determine if free-ranging deer in the surrounding area are also infected. These types of spatial data, in conjunction with facility inventories, could also be used to calculate approximate stocking densities. These could also be useful to predict the speed with which CWD might progress through a particular area. Maintaining spatial data would also promote compatibility with the increasing amounts of spatial data maintained on free-ranging wildlife and other natural resources.

5.1.3.2.3 *CWD testing procedures*: The MDA sends all CWD samples to the Diagnostic Center for Population and Animal Health (DCPAH) at Michigan State University (MSU) for testing. The DCPAH is able to conduct preliminary screening tests for CWD, but the USDA's National Veterinary Services Laboratory (NVSL) in Ames, Iowa must confirm all presumptive positives. The MDA CWD testing protocol requires that immunohistochemistry (IHC) be used to test for prion protein in brainstem tissue. Hibler et al. (2003) determined that using an enzyme-linked immunosorbent assay (ELISA) on retropharyngeal lymph nodes mule deer, WTD and elk was more cost effective, 100% specific, and >98% sensitive for CWD. In addition, that study found that IHC on brainstem tissue alone missed 22% of CWD-positive mule deer and 7% of CWD-positive elk. Consequently, ELISA screening of lymph nodes was more effective at detecting

CWD than IHC of brainstem. Many certified laboratories and state/provincial surveillance programs for free-ranging cervids (including MDNR, WI Department of Natural Resources, and the CO Division of Wildlife) in North America have changed their CWD testing protocols and now use this ELISA as a screening test on lymph nodes. Turn around time for the test is reduced dramatically, often from weeks to days, samples are less expensive to test, and lymph nodes are much easier to collect and remain usable longer, despite tissue decay, than brainstem. This last point is a critical one from a logistical standpoint, since it often takes days for samples to be collected and transported to the lab, during which time, depending on weather and other factors, brain tissue can decompose to the point where it can give inaccurate or inconclusive results or be completely unusable for testing. All of these factors increase the risk of CWD going undiagnosed in C/P-OC, either by missing animals or by undermining producer confidence in the tests to the point where they do not submit cases for testing. In many cases, state agriculture agencies like MDA are mandated to comply with USDA testing programs, so MDA may not be able to modify its choice of testing protocol. In addition, IHC will need to remain the test of choice for species other than mule deer, WTD and elk, due to the current lack of ELISA data for those species. However, WTD and elk make up over 92% of the C/P-OC in MI, and for these species at least , adoption of the ELISA test on lymph nodes as the screening component of CWD testing should be seriously considered.

In comments that audit inspectors recorded, at least 1 facility owner expressed concern over the MDA CWD testing program and has refused to submit samples due to lack of confidence in MDA's ability to track samples accurately. While this producer's opinion may be isolated, producers who provide samples need to trust sample submission, handling, and tracking protocols.

The poor compliance with MDA's current mandatory CWD testing program was discussed at length in Section 5.1.2 . The CWD status of the Michigan C/P-OC population currently cannot be determined with any certainty. That fact alone constitutes one of the two most serious risks of CWD introduction noted during the audit.

5.1.3.3 Individual animal identification. Current regulations allow considerable flexibility in how C/P-OC can be identified, as noted above in Section 5.1.1. While such compliance flexibility is understandably desirable from the perspective of producers, it presents problems from the standpoint of disease prevention and control, problems which increase the risk of CWD introduction and propagation. There is currently no requirement for a consistent identification format that would allow standardization of recordkeeping across the entire C/P-OC industry and, more importantly, allow a particular individual C/P-OC to be tracked uniquely throughout its lifetime.

An animal identification system that minimizes CWD risk should provide identification that is unique and exclusive to one individual, allowing the individual to be traced from facility to facility throughout its movement history. Ideally, the state marking system would interface with a national marking system allowing for interstate movements to be monitored. The United States National Animal Identification Development (USAID) team was founded in 2002 to develop a program for identification of livestock nationwide. The plan calls for individual numbers for livestock that can track movements of individual animals. The South Dakota Department of Agriculture has a similar system for C/P-OC. A unique identifier would facilitate enforcement of POCPMA. If an C/P-OC escapes from a facility and is not reported, an occurrence found to be common by this audit, the unique identifier could be linked directly to a responsible facility. Linked to a nationwide animal identification database, enforcement of the moratorium on interstate movements would also be made more efficient.

5.1.3.4 Recovery protocol for escapes. Responsibility to report C/P-OC escapes currently lies with the facility alone. The large number of escapes reported to auditors that were never reported to MDA suggest current implementation of regulations is inadequate. Under the current system, an escaped CWD-infected C/P-OC could be outside the fence for days before it is reported, if it is reported at all, allowing ample opportunity for exposure of free-ranging cervids.

An escape reporting/recovery protocol that would minimize risks of CWD transmission from C/P-OC to free-ranging cervids would require immediate reporting. Currently, if the facility chooses to report an escape, and the escape occurs outside of normal business hours, response will be delayed by as few as 15 or as many as 63 hours. MDNR currently runs a 24 hour Report All Poaching telephone hotline to deal with violations of natural resource laws. A similar arrangement would be one option for alleviating delays in reporting of C/P-OC escapes. An education program encouraging reporting of suspected C/P-OC escapes by the general public could also prove helpful.

The OSRPOCF specifies that escaped cervids will remain C/P-O as long as official identification remains intact and the owner follows MDA procedures for recovery, yet those procedures are not specified in any detail. The amount of time allowed for recovery of escaped C/P-OC is at the discretion of MDA in consultation with MDNR and is not explicitly stated in regulations. Beyond their interest in recovering a particularly valuable animal (which also depends on fluctuating market values), there is currently little incentive for C/P-OC owners to work diligently and quickly to report and recover escaped cervids. One possible means of providing compelling incentive would be to specifically designate that unreported escaped C/P-OC automatically become public property, and so under the exclusive management authority of MDNR. They would be immediately subject to harvest by agency personnel or the public, at MDNR direction and discretion. The regulatory basis for such a designation already appears to be in place in POCPMA, which notes (2000, p. 9) that "an animal that escapes from a facility is considered to be public property if the operator of a cervidae livestock facility does not notify the department (MDA)." Once escaped C/P-OC are harvested, all should be tested for CWD at the expense of the C/P-OC facility of origin. Uniformly mandated unique animal identification would facilitate attribution of responsibility to a particular facility so that expenses related to recovery and testing of the escapee could be recovered by the State.

5.1.3.5 Oversight responsibilities.

5.1.3.5.1 *Inspection intervals*. Current regulations (OSRPOCF 2000) provide that C/P-OC facilities be inspected at least every 3 years and that inspection intervals be determined on a risk-basis. MDNR audit inspection teams identified numerous areas of potential CWD risk, particularly regarding fences and CWD testing, that justify inspections at more frequent intervals. In addition, specific provisions for unannounced inspections of C/P-OC facilities are warranted given the lack of compliance documented during the audit and the potential consequences of CWD introduction into MI.

5.1.3.5.2 *Annual reporting requirements.* Facility owners must submit annual fence inspection records and inventory reports. The inventory does not require reporting of individual animal identification numbers, gender and age of animals on site, origin of live cervids added to the herd, information on testing of deaths and culls for CWD, etc. As a result, it is difficult to look at yearly inventories and determine if the facility is in compliance for all record keeping and animal movement regulations. The inventory report should include all animals, with unique identification numbers, gender, and age, at the facility at the end of the calendar year. In addition, documentation for all animals

added to or removed from the facility, including animal identification, species, gender, date moved, origin, and destination, should be included in the inventory. It is mandatory that these records be kept, and they should be submitted yearly for verification of compliance. Records submitted should be in a uniform format and, after a reasonable transition period, be in electronic form.

5.1.3.5.3 *Costs/lack of funding mechanisms and enforcement.* During summer 2004, 506 facilities were inspected during this audit at a cost of over $560,000. With the exceptions noted in this Discussion section, regulations appear to be in place to adequately regulate the C/P-OC industry, but the results of this audit suggest enforcement of some of these regulations has not been sufficiently stringent. In all likelihood, this has primarily been due to lack of personnel and funding resources necessary to ensure compliance.

In addition, serious discussions should take place to define areas where more severe penalties for non-compliance are appropriate and to establish a more comprehensive fee system to generate the funds necessary for adequate oversight of the C/P-OC industry. Establishing programs to promote and market the industry also could be beneficial, since prosperity in the C/P-OC industry would help generate the resources necessary for oversight and lessen the likelihood of facility abandonment and its associated risks for CWD introduction.

5.2 Conducting the audit: lessons learned and recommendations for future auditors. Overall, the inspection process was a successful endeavor for many reasons. First, the inspection teams collected invaluable data regarding disease risk for both C/P-OC and free-ranging cervids in Michigan and answered questions from C/P-OC owners. Second, the interactions between C/P-OC facility owners and audit teams were largely cooperative, and facility owners were willing to help MDNR field personnel in any way possible. Third, conducting inspections strengthened the relationships among conservation officers and biologists in the field by requiring teamwork. Lastly, the audits allowed MDNR personnel to become familiar with the C/P-OC industry and, therefore, understand some of the business constraints with which facility owners struggle. This understanding will aid agency personnel when establishing and re-visiting regulations for C/P-OC facilities in the future.

Another lesson was that technology can be both a friend and a foe. Problems operating and downloading GPS units were not uncommon, especially early in the inspection process, but once the field teams were aware of the protocol, the GPS units worked well and allowed for accurate and easy data collection. Use of personal digital assistants (PDAs) by field personnel for data collection would have saved an extraordinary amount of time, and we highly recommended their use for others who may be faced with a similar audit. Initially, the goal of the Questionnaire and Audit Committee was for field inspection teams to administer the questionnaire to the C/P-OC facility representative and record answers on PDAs that could be uploaded to a central database in Lansing, saving numerous hours in data entry. The MDNR WLD currently uses this system for data management of WTD hunter harvest information. This intended approach was never implemented because the Committee did not have ample time to set up the system and write the necessary software prior to the beginning of inspections on June 15, 2004. Use of PDAs would have decreased variability in data collection, because field inspection teams would have been constrained in their answers to a list of options, rather than being allowed to write out answers in comment fields. This would have minimized data clean up.

There was considerable variability in inspection teams' judgments of compliance by management unit, which is to some extent unavoidable given different perspectives on the inspection process. However, some of the variation could have been eliminated during the training session. The training covered how to conduct the audits (i.e., how to operate the GPS units and cameras, how to ask questions, how to act around C/P-OC, biosecurity issues, etc.), but focused less on the specifics of the C/P-OC regulations themselves and how to enforce them. The main outcomes from inspections were

to determine what needed to be fixed, what was maintained properly, and whether the facility was in compliance with all regulations governing C/POC facilities in Michigan. As a result, a quick flow chart of compliance decision making may have helped inspection teams with summary compliance judgments. Efforts in other states should specifically review pertinent state or provincial regulations to make questionnaires consistent with them and to focus audit inspections on specific aspects of regulatory compliance.

Inspection teams learned a great deal about some of the frustrating death losses experienced by C/P-OC facilities in Michigan. Poaching was a major concern for C/P-OC facility owners, and facility owners did not fully understand the methods for enforcement and prosecution of individuals poaching C/P-OC. It was often unclear to them whether MDNR conservation officers or local sheriff's departments should be called in for poaching cases. In addition, feral dogs reportedly caused numerous deaths/injuries on MI C/P-OC facilities.

.

6. Summary and conclusions

In spite of the unique characteristics of CWD as a disease, many of the risks for its introduction and propagation identified during the course of this audit are recurring themes in the surveillance and control of other contagious diseases in other species. While many issues of note, both positive and negative, were found in these inspections of Michigan C/P-OC facilities, the following stand out as deserving comments and recommendations:

- Efforts to minimize the risks of introduction and propagation of CWD via C/P-OC in Michigan begin and end with individual animal identification. The current animal identification regulations are inadequate because they do not require facility owners to identify all C/P-OC or to identify them all in a unique and uniform way. A system must be implemented that is mandatory, uniform across all facilities and classes, and that provides unique identification to each individual by which the animal can be traced throughout its lifetime. All animals must be identified by 1 year of age, and the appropriate state agency must issue and administer the identification system. The identification must also be easily visible so that each and every animal is clearly identified as a C/P-OC in the event of escape. In calling for this requirement, we understand that identification of every animal may be very difficult for Ranch facilities because of their size and their inherently less intensive management and handling of the animals. Nonetheless, individual animal identification is so critical to minimizing and managing disease risk that facilities such as Ranches that cannot reliably and verifiably identify each and every individual should be subject to more stringent and vigorously enforced fencing and biosecurity regulations to ensure that unmarked animals do not leave the facility alive under any circumstances.

- Along with animal identification, CWD testing of Michigan C/P-OC, or more accurately, the lack of testing, was the greatest risk for introduction and propagation of the disease identified during this audit. In spite of a "mandatory" testing program for all C/P-OC over 16 months of age that die plus a representative percentage of culls, nearly 90% of the reported C/P-OC deaths were not tested for CWD. While some facilities have tested in good faith, nearly half of the audited Ranch and Full Registration facilities reported that they had submitted no CWD tests at all. Without adequate CWD testing, the introduction of CWD into the State's C/P-OC cannot be detected. More ominously, this same lack of testing means that we cannot rule out the possibility the disease is already here and currently propagating undetected. Steps have been taken jointly by MDA and MDNR to notify producers of testing requirements and provide information about sample submission (letter dated Nov 15, 2004).

- The lack of a specified protocol for de-commissioning or de-registering a C/P-OC facility is a risk for introduction and propagation of CWD. Audit inspection teams found a number of facilities that wanted to leave the C/P-OC business but had little guidance from regulations on how to decommission. As a result, understandably frustrated or desperate facility owners may deal with the situation in a way they deem appropriate, which, at worst, could mean releasing their C/P-OC into the free-ranging cervid population. Appropriate regulations should be developed speedily, and those regulations should provide for an outreach/education program to inform and assist C/P-OC producers who wish to leave the business and get rid of their animals.

- Procedures to deal with facility abandonment are conspicuously absent and critically needed. As an example, when inspectors visited a facility during the audit, fences were down, the C/P-OC were gone, and the owner had moved out of state. In such cases, given the currently inadequate regulatory provisions for individual animal identification and recordkeeping, there is no way to be sure what happened to the C/P-OC or verify the CWD risk those animals, or the land once used as a C/P-OC

facility, pose to the free-ranging cervid population. Penalties for cases where an owner just "walks away" from a facility should be sufficiently severe to provide a strong deterrent for this unacceptable behavior.

- A current area of risk for CWD introduction and propagation for which both C/P-OC facilities and regulating state agencies bear some burden of responsibility is that of inadequate recordkeeping. To the credit of the C/P-OC industry, the vast majority of inspected facilities not only keep records, but the records they keep were judged to be in compliance with current regulations. However, the current regulations are not particularly stringent when viewed in the context of what is required of a recordkeeping system in order to minimize disease risks. For example, most of the records kept are on paper, and while they comply with current regulations, lack of simultaneous accessibility of these records by the multiple parties necessary to ensure adequate disease surveillance presents an obvious risk. In addition to the issues discussed relative to animal identification, the State needs to reevaluate and improve the way it gathers and stores regulatory information from C/P-OC facilities so that the information is rapidly, efficiently, and widely accessible to multiple agencies and to the producers, and so that important data linkages are maintained. The development of an electronic data collection, archiving, and reporting system to aid compliance, enforcement, and disease risk assessment should be a high priority. Such a system is currently lacking, and its design, development, and implementation should involve both information technology and disease control specialists to ensure an adequate system is developed.

- These audit findings also revealed the risk of C/P-OC escapes. In spite of the fact that reporting of "releases" is mandatory in current regulations, it is clear not only that escapes occur but that they are rarely reported. Of 464 escapes reported to audit inspectors, only 8 releases were apparently reported to MDA. Twenty percent of Class IV and about 14% of Class III C/P-OC facilities experienced escapes, which is likely to be an underestimate. Adding to the risk is the fact that only half of the escaped C/P-OC from Ranches bore identification. Most escaped C/P-OC were reported to have been recovered, yet the time allowed for reporting and recovery under current regulations is sufficient to add substantial risk of CWD introduction even for recovered animals. The development of more stringent escape and recovery protocols, along with enforcement and stiffening of penalties for non-reporting, is critical. Consideration should be given to measures which would allow agencies to dictate the rapidity and conduct of recovery operations based on risk and automatically make unreported escaped C/P-OC public property and subject to immediate harvest. These protocols should include measures to explicitly provide authority to agencies to manage the harvest of non-native cervid species. The Natural Resources Commission approved regulations to allow harvest of escaped exotic cervids in January 2005. The documentation by this audit of another practice, the intentional release of C/P-OC into the wild, is also both notable and deeply troubling.

- Specific, uniform and unequivocal regulatory requirements for the composition and maintenance of perimeter fencing should be developed and enforced. Current regulations specify that fences be constructed only of woven wire, yet in practice, C/P-OC facilities use a variety of other materials that agencies consider to be in compliance with the standards. Some of these materials very likely are adequate. Updated regulations should include specific guidance such as (but not limited to) minimum gauge of wire, mesh size, and distance between posts. In addition, the revised regulations need to address the current problematic conflict in fencing standards, which both specify minimum fence heights by species, yet also specify that fences need to prevent the ingress and egress of any cervid species. We cannot overstate the crucial role of fences in minimizing the risks of CWD introduction and propagation. In spite of their similar appearances, C/P-OC and free-ranging cervids are separate populations from the standpoint of disease control, and the separation between those populations must be maintained at all times. Good fences not only protect free-ranging cervids from C/P-OC, but vice versa.

- Some summary mention of Ranch facilities is warranted because of their unique characteristics and the unique risks they hold for CWD introduction and propagation. This audit found that of the 4 facility classes, Ranches enclosed the largest number of CWD-susceptible C/P-OC (>18,000 statewide), imported the largest numbers of C/P-OC from out-of-state sources (including from CWD-positive states), had the largest percentage of animals lacking individual identification, had the lowest rate of CWD testing, and had the lowest rates of recovery and identification of escapees. In addition, Ranch facilities are located in areas with some of the highest free-ranging WTD densities in the state. If CWD were to infect C/P-OC that subsequently escape from one of these facilities, propagation of CWD in the surrounding free-ranging population would likely be rapid. We do not intend these remarks to stigmatize all Ranch facilities. Some of the best managed C/P-OC facilities in the state are Ranches. However, because of this combination of factors that increase CWD risks, serious consideration should be given to making registration and fencing requirements for Ranches more stringent than those for other classes of C/P-OC facilities. This may help provide greater assurance that registered facilities will be well managed and economically self-sufficient, and capable of providing needed disease surveillance and management safeguards.

- An emerging issue with respect to the risks of CWD introduction and propagation is potential environmental contamination via the manure or carcasses of infected animals. This audit was able to gather some of the first information on the ways that C/P-OC facilities manage and dispose of these materials. This is an area where development of workable regulations should be an ongoing priority for both agriculture and natural resource agencies. While the attention paid to issues of carcass and manure management and disposal is likely to increase in the future because of recent research findings, agencies and the industry must also keep the place of these items in proper perspective within the context of the overall risks of CWD transmission. The available research and the current scientific opinions of preeminent CWD scientists agree that the highest risks for introduction and propagation of the disease are the movements of, and contact between, live animals. The role played by carcasses and manure from infected animals, while by no means negligible, is a distant second in terms of risk importance, with contamination of machinery and equipment an even more distant third. It is critical that disease control experts and policy makers keep this relative risk ranking in mind so that attention, as well as limited time and resources, are not diverted from the most important sources of CWD risk.

- Measures of the overall non-compliance of C/P-OC facilities (37% of C/P-OC facilities judged non-compliant by audit inspectors) essentially speak for themselves. While the validity and meaning of these measures can be debated, clearly an appreciable amount of non-compliance exists among C/P-OC facilities overall, and there is substantial room for improvement.

In many respects, identifying the need for improvements in the C/P-OC industry to minimize the risks of introduction and propagation of CWD, and even suggesting remedies, is the easy part of the process. Much more difficult is the task of finding and applying sufficient resources to make the remedies happen. Agencies and policy makers should harbor no illusions about the amount of funding, personnel, and time needed to ensure the implementation and enforcement of the measures suggested in this report. All will be sizeable, but such support will be necessary if Michigan is serious about minimizing disease risks. It is only fair to point out that many of the problems identified with respect to current C/P-OC regulations and their implementation may have been largely due to a failure to provide the money and expertise necessary to do the job properly. In the end, measures taken to prevent the introduction and spread of CWD to Michigan will benefit both free-ranging cervids and C/P-OC, and the methods devised to fund risk mitigation measures should reflect that fact.

References

AIA 1988. Animal Industry Act, Public Act 466 of 1988, Michigan Code of Laws.

Belay ED, Maddox RA, Williams ES, Miller MW, Gambetti P and Schnonberger LB 2004. Chronic wasting disease and potential transmission to humans. Emerg. Infect. Dis. 10(6):977-984.

BODA 1982. Bodies of Dead Animals, Public Act 239 of 1982, Michigan Code of Laws.

Brown P, Rau EH, Johnson BK, Bacote AE, Gibbs CJ Jr. and Gajdusek DC 2000. New studies on the heat resistance of hamster-adapted scrapie agent: Threshold survival after ashing at 600ºC suggests an inorganic template of replication. Proc. Nat. Acad. Sci. U.S. 97(7):3418-3421.

Coon TG, Campa H, Felix A, Kaneene J, Lupi F, Peyton B, Schulz M, Sikarskie J, Vande Haar M and Winterstein S 2000. Farming captive cervids in Michigan: a review of social, economic ecological and agricultural opportunities and risks. White paper, Departments of Agricultural Economics, Animal Science, and Fisheries and Wildlife, College of Agriculture and Natural Resources, and College of Veterinary Medicine, Michigan State University. 118 pp. Available from http://www.fw.msu.edu/publications/White%20Paper%207%203%2000.pdf , accessed 19 October 2004.

CWD Alliance 2004. A summary of Chronic Wasting Disease and Cervidae Regulations by State and Province. Data as of February 4, 2004. Table created and updated by Michigan Dept. of Natural Resources for the National Chronic Wasting Disease Task Force. Chronic Wasting Disease Alliance. Available from http://www.cwd-info.org/index.php/fuseaction/policy.regulations , accessed 4 November 2004.

de Lisle GW, Bengis RG, Schmitt SM and O'Brien DJ 2002. Tuberculosis in free-ranging wildlife: detection, diagnosis and management. Rev. Sci. Tech. O.I.E. 21(2):317-334.

Godfroid J 2002. Brucellosis in wildlife. Rev. Sci. Tech. O.I.E. 21(2):277-286.

Granholm J 2003a. Governor's Chronic Wasting Disease Task Force. Executive order 2003-5. Executive Office of the Governor, 28 February 2003, 4 pp.

Granholm J 2003b. Governor's Chronic Wasting Disease Task Force, Amendment of Executive Order 2003-5. Executive order 2003-13. Executive Office of the Governor, 15 September 2003, 1 p.

Granholm J 2004. Regulation and Biosecurity of Privately-owned Cervidae Livestock Facilities and Operations Executive Reorganization. Executive order 2004-3. Executive Office of the Governor, 15 April 2004, 6 pp. Available from http://www.michigan.gov/cwd/0,1607,7-177--90877--,00.html , accessed 24 October 2004.

Gross JE and Miller MW 2001. Chronic wasting disease in mule deer: disease dynamics and control. J. Wildl. Manage. 65(2):205-215.

Hibler CP, Wilson KL, Spraker TR, Miller MW, Zink RR, DeBuse LL, Andersen E, Schweitzer D, Kannedy JA, Baeten LA, Smeltzer JF, Salman MD and Powers BE 2003. Field validation and assessment of an enzyme-linked immunosorbent assay for detecting chronic wasting disease in mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*) and Rocky Mountain elk (*Cervus elaphus nelsoni*). J. Vet. Diagn. Invest. 15:311-319.

Joly DO, Ribic CA, Langenberg JA, Beheler K, Batha CA, Dhuey BJ, Rolley RE, Bartelt G, Van Deelen TR and Samuel MD 2003. Chronic wasting disease in free-ranging Wisconsin white-tailed deer. Emerg. Infect. Dis. 9(5):599-601.

MDA 2002. Chronic Wasting Disease (CWD) Mandatory Surveillance Program. Available from http://www.michigan.gov/mda/0,1607,7-125-1566_2310_13284-28141--,00.html , accessed 1 November 2004.

MDA 2004. Part 01: Intro to Cervid CWD Sample Submission Protocol. Submission protocol. Available from http://www.michigan.gov/mda/0,1607,7-125-1566_2310_13284-65642--,00.html , accessed 1 November 2004.

MDNR/MDA 2002. Michigan Surveillance and Response Plan for Chronic Wasting Disease of Free-ranging and Privately-owned/Captive Cervids. Wildlife Division, Michigan Department of Natural Resources and Animal Industries Division, Michigan Department of Agriculture, 26 August 2002, 19 pp.

Michigan CWD Task Force 2003. Final Report, Michigan Chronic Wasting Disease Task Force, prepared for Governor Jennifer Granholm. October 15, 2003, 29 pp. Available from http://www.michigan.gov/documents/cwd_final_report_75838_7.pdf , accessed 24 October 2004.

Miller MW 2004. Letter to representatives of the Western Wildlife Health Committee regarding CWD transmission from carcasses, dated 29 July 2004.

Miller MW and Williams ES 2003. Horizontal prion transmission in mule deer. Nature 425:35-36.

Miller MW and Wild MA 2004. Epidemiology of chronic wasting disease in captive white-tailed and mule deer. J. Wildl. Dis. 40:320-327.

Miller MW, Wild MA and Williams ES 1998. Epidemiology of chronic wasting disease in captive Rocky Mountain elk. J. Wildl. Dis. 34:532-538.

Miller MW, Williams ES, McCarty CW, Spraker TR, Kreeger TJ, Larsen CT and Thorne ET 2000. Epizootiology of chronic wasting disease in free-ranging cervids in Colorado and Wyoming. J. Wildl. Dis. 36:676-690.

Miller MW, Williams ES, Hobbs NT and Wolfe LL 2004. Environmental sources of prion transmission in mule deer. Emerg. Infect. Dis. 10(6):1003-1006.

Nebraska Game and Parks Commission 2002. CWD test results, northern Sioux County, NE. Sampling periods: November 2001 and January through April 2002. Available from http://www.ngpc.state.ne.us/wildlife/guides/cwd/cwd_edwards_buffer051502small.jpg , accessed 20 October 2004.

NREPA 1994a. Natural Resources and Environmental Protection Act, Public Act 451 of 1994, Michigan Code of Laws. Article III: Natural Resources Management, Chapter 2: Management of Renewable Resources, Subchapter 1: Wildlife, Possession-Sale-Regulation of Wildlife, Part 427:Breeders and Dealers.

NREPA 1994b. Natural Resources and Environmental Protection Act, Public Act 451 of 1994, Michigan Code of Laws. Article III: Natural Resources Management, Chapter 2: Management of Renewable

Resources, Subchapter 1: Wildlife, Possession-Sale-Regulation of Wildlife, Part 401: Wildlife Conservation.

O'Rourke KI, Zhuang D, Lyda A, Gomez G, Williams ES, Tuo W and Miller MW 2003. Abundant PrP^{CWD} in tonsil from mule deer with preclinical chronic wasting disease. J. Vet. Diagn. Invest. 15:320-323.

OSRPOCF 2000. Operational Standards for Registered Privately Owned Cervidae Facilities. Michigan Department of Agriculture, May 2000, 5 pp.

POCPMA 2000. Privately Owned Cervidae Producers Marketing Act, Public Act 190 of 2000, Michigan Code of Laws.

Raymond GJ, Bossers A, Raymond LD, O'Rourke KI, McHolland LE, Bryant PK III, Miller MW, Williams ES, Smits M and Caughey B 2000. Evidence of a molecular barrier limiting susceptibility of humans, cattle and sheep to chronic wasting disease. EMBO J. 19(17):4425-4430.

SCWDS 2002. Special CWD Issue (Doster GL, Ed.). Southeastern Cooperative Wildlife Disease Study (SCWDS) Briefs 18(1):1-16.

Sigurdson CJ, Williams ES, Miller MW, Spraker TR, O'Rourke KI and Hoover EA 1999. Oral transmission and early lymphoid tropism of chronic wasting disease PrP^{RES} in mule deer fawns (*Odocoileus hemionus*). J. General Virol. 80:2757-2764.

Sigurdson CJ, Spraker TR, Miller MW, Oesch B and Hoover EA 2001. PrP^{CWD} in the myenteric plexus, vagosympathetic trunk and endocrine glands of deer with chronic wasting disease. J. General Virol. 82:2327-2334.

Spraker TR, Miller MW, Williams ES, Getzy DM, Adrian WJ, Schoonveld GG, Spowart RA, O'Rourke KI, Miller JM and Merz PA 1997. Spongiform encephalopathy in free-ranging mule deer *(Odocoileus hemionus)*, white-tailed deer *(Odocoileus virginianus)*, and Rocky Mountain elk *(Cervus elaphus nelsoni)* in northcentral Colorado. J. Wildl. Dis. 33:1-6.

Spraker TR, Zink RR, Cummings BA, Wild MA, Miller MW and O'Rourke KI 2002. Comparison of histological lesions and immunohistochemical staining of proteinase resistant prion protein in a naturally-occurring spongiform encephalopathy of free-ranging mule deer (*Odocoileus hemionus*) with those of chronic wasting disease of captive mule deer. Vet. Pathol. 39:110-119.

Thrusfield M 1995. The ecology of disease. In: Veterinary Epidemiology, 2nd Edition. Oxford, Blackwell Science Ltd., pp. 97-113.

Williams ES and Young S 1980. Chronic wasting disease of captive mule deer: a spongiform encephalopathy. J. Wildl. Dis. 16:89-98.

Williams ES and Miller MW 2002. Chronic wasting disease in deer and elk in North America. Rev. Sci. Tech. O.I.E. 21(2):305-316.

Williams ES, Miller MW, Kreeger TJ, Kahn RH and Thorne ET 2002. Chronic wasting disease of deer and elk: a review with recommendations for management. J. Wildl. Manage. 66(3):551-563.

Wolfe LL, Miller MW and Williams ES 2004. Feasibility of “test-and-cull” for managing chronic wasting disease in urban mule deer. Wildl. Soc. Bull. 32(2):500-505.

Appendix A
Audit Inspection Forms and Protocols

Exhibit 1. Audit and Inspection Questionnaire

Privately Owned Cervidae Facility Inspection Questionnaire

BUSINESS SECTION

1. Permit Number:

2. Facility Name:

3. Facility Location (County and City):

4. Beginning date and time of facility inspection.

5. Ending date and time of facility inspection.

Month:

6. When did operation begin at this location?

Year:

7. Who are the current and past employees under the current ownership?

8. What other individuals or businesses are included with this operation?

9. How are the individuals or businesses named above involved (e.g. silent partner, etc.)?

10. Do you own any other captive cervid facilities in Michigan or outside the state?

☐ **In Michigan** ☐ **Out-of-state**

11. Where (facility/city/state) did the original cervids come from?

12. Have cervids been purchased and/or sold at auction during the last 4 years?

☐ **No**

☐ **Yes**

Auction Location and Dates:

13. Business Comments:

CURRENT CERVID INVENTORY AND HEALTH SECTION

1. Whitetail Deer

Female Count: **Male Count:** **Origin (state/country):**

2. Elk

Female Count: **Male Count:** **Origin (state/country):**

3. Mule Deer

Male Count: **Female Count:** **Origin (state/country):**

4. Red Deer

Female Count: **Male Count:** **Origin (state/country):**

5. Fallow Deer

Female Count: **Male Count:** **Origin (state/country):**

6. Other Species

Species: **Male Count:** **Female Count:**

Origin (state/country):

7. Are different cervid species co-mingled?

- ☐ **No**
- ☐ **Yes**

- ☐ **Whitetail Deer**
- ☐ **Mule Deer**
- ☐ **Fallow Deer**
- ☐ **Other**
- ☐ **Elk**
- ☐ **Red Deer**

Other Description:

8. Which species have adjacent pens?

- ☐ **Whitetail Deer**
- ☐ **Mule Deer**
- ☐ **Fallow Deer**
- ☐ **Other**
- ☐ **Elk**
- ☐ **Red Deer**

Other Description:

9. How are individual cervids identified?

- ☐ USDA Ear Tag
- ☐ Other Ear Tag
- ☐ No Identification
- ☐ Other
- ☐ Electronic ID
- ☐ Tattoo

Other Description:

10. At what age (in months) are cervids when marked?

11. How are individual cervids identified during transport?

- ☐ USDA Ear Tag
- ☐ Other Ear Tag
- ☐ No Identification
- ☐ Other
- ☐ Electronic ID
- ☐ Tattoo

Other Description:

12. Do any cervids have fence line contact with free ranging cervids?

- ☐ No
- ☐ Yes

13. Are supplements fed to cervids?

- ☐ No
- ☐ Yes

14. How many months have supplements been fed?

15. What supplements are fed to cervids? (producer and where bought, or obtain feed tag)

16. Who is this facility's current cervid veterinarian? (name and city)

17. How many years has this veterinarian been serving this facility?
18. Approximately how many times a year does this veterinarian visit this facility?
19. Cervid Inventory and Health Comments:

CERVID ESCAPES AND RELEASES SECTION (During last 4 years)

1. Have cervids escaped from this facility?

- ☐ No
- ☐ Yes

Escaped Count:

- ☐ Whitetail Deer
- ☐ Mule Deer
- ☐ Fallow Deer
- ☐ Other
- ☐ Elk
- ☐ Red Deer

Other Description:

2. Were escaped cervids recovered?

- ☐ No
- ☐ Yes

Recovered Count:

3. Reason(s) for cervid escapes:

- ☐ Fencing Problems
- ☐ Handling Loss
- ☐ Other
- ☐ Gate Left Open

Other Description:

4. Were escaped cervids tagged prior to escape?

- ☐ No
- ☐ Unknown
- ☐ Yes

If Yes, how where they tagged?

- ☐ USDA Ear Tag
- ☐ Other Ear Tag
- ☐ No Identification
- ☐ Other
- ☐ Electronic ID
- ☐ Tattoo

Other Description:

5. Were escaped cervids placed in an isolation facility after recovery?

- ☐ No
- ☐ Yes

6. Have cervids ever been intentionally released?

- ☐ No
- ☐ Yes

Release Count:

If Yes, what species were released?

- ☐ Whitetail Deer
- ☐ Mule Deer
- ☐ Fallow Deer
- ☐ Other
- ☐ Elk
- ☐ Red Deer

Other Description:

7. Why were cervids intentially released?

8. Has this facility experienced any other cervid losses (e.g. theft)?

- ☐ No
- ☐ Yes

If Yes, describe circumstances:

9. Cervid Escapes and Releases Comments:

CERVID MORTALITY AND BY-PRODUCT SECTION (During last 4 years)

1. How many cervid deaths have occurred at this facility due to:

Harvest? **Illness?** **Other causes?**

2. How many cervid deaths were tested for CWD?

3. What cervid species have died in the facility due to illness?

- ☐ Whitetail Deer
- ☐ Mule Deer
- ☐ Fallow Deer
- ☐ Other
- ☐ Elk
- ☐ Red Deer

Other Description:

4. Were any cervid deaths necropsied?

- ☐ No
- ☐ Yes

Necropsy Results: **Who Necropsied?**

5. How are cervid carcasses and/or entrails disposed?

- ☐ Above Ground
- ☐ Rendered
- ☐ Other
- ☐ Buried up to 3 ft.
- ☐ Buried deeper than 3 ft.

Other Description:

6. Where are cervid carcasses and entrails disposed?

- ☐ Within Enclosure
- ☐ Licensed Landfill
- ☐ Off-site
- ☐ Outside Enclosure

Other Description:

7. How many velvet antlers have been sold from this operation?

8. Does this operation buy and/or sell cervid semen?

☐ **Buy** ☐ **Sell**

Sale details (name/city/state):

9. Does this operation buy and/or sell cervid urine?

☐ **Buy** ☐ **Sell**

10. Does this operation buy and/or sell doe scent?

☐ **Buy** ☐ **Sell**

11. Cervid Mortality and By-Product Comments:

OUT-OF-STATE PURCHASES SECTION (During last 3 years)

1. Have cervids been purchased from out-of-state?

- ☐ No
- ☐ Yes

From Whom (name/city/state):

2. Which cervid species have been purchased from out-of-state?

- ☐ Whitetail Deer
- ☐ Mule Deer
- ☐ Fallow Deer
- ☐ Other
- ☐ Elk
- ☐ Red Deer

Other Description:

3. How many cervids have been purchased from out-of-state?

4. Was a Veterinary Inspection Certificate received with each out-of-state purchase?

- ☐ No
- ☐ Yes

5. Was each cervid purchased from out-of-state TB tested?

- ☐ No
- ☐ Yes

If Yes, Who tested?

6. Have you or other employees picked up cervids purchased from out-of-state?

- ☐ Pick Them Up
- ☐ Shipment Arranged

Shipped By:

7. Did an animal broker arrange one or more out-of-state sales?

- ☐ No
- ☐ Yes

Number of Cervids Purchased: **Broker Name(s):**

8. Out-Of-State Purchases Comments:

OUT-OF-STATE CERVID SHIPMENTS SECTION (During last 3 years)

1. Have cervids from this facility been shipped out-of-state?

- ☐ No
- ☐ Yes

If Yes, what species were shipped?

- ☐ Whitetail Deer
- ☐ Mule Deer
- ☐ Fallow Deer
- ☐ Other
- ☐ Elk
- ☐ Red Deer

Other Description:

2. How many cervids were shipped out-of-state?

3. To whom were cervids shipped out-of-state? (Recipients name/city)

4. Have you or other employees transported cervids out-of-state?

- ☐ No
- ☐ Yes

Recipients (name/city):

5. Who transported cervids out-of-state (other than yourself)?

List names/cities:

6. Did each cervid shipped out-of-state have a Veterinary Inspection Certificate?

- ☐ No
- ☐ Yes

7. Did each cervid shipped out-of-state have a TB test?

- ☐ No
- ☐ Yes

8. Are cervid meat products shipped out-of-state?

- ☐ No
- ☐ Yes

Recipients (name/city) and Products:

9. Out-Of-State Cervid Shipments Comments:

IN-STATE CERVID SHIPMENTS SECTION (During last 3 years)

1. Have cervids from this facility been shipped in-state?

- ☐ No
- ☐ Yes

If Yes, what species were shipped?

- ☐ Whitetail Deer
- ☐ Mule Deer
- ☐ Fallow Deer
- ☐ Other
- ☐ Elk
- ☐ Red Deer

Other Description:

2. How many cervids were shipped in-state?

3. To whom were cervids shipped in-state? (Recipients name/city)

4. Have you or other employees transported cervids in-state?

- ☐ No
- ☐ Yes

Recipients (name/city):

5. Who transported cervids in-state (other than yourself)?

List names/cities:

6. Did each cervid shipped in-state have a Veterinary Inspection Certificate?

- ☐ No
- ☐ Yes

7. Did each cervid shipped in-state have a TB test?

- ☐ No
- ☐ Yes

8. Are cervid meat products shipped in-state?

- ☐ No
- ☐ Yes

Recipients (name/city) and Products:

9. In-State Cervid Shipments Comments:

CERVID BREEDING SECTION (During last 3 years)

1. How many cervid births have occurred at this facility?

2. Have other person's cervids been kept at this facility?

- ☐ **No**
- ☐ **Yes**

If Yes, describe (names/addresses/types/counts):

3. Have one or more bucks been transferred into/out of this facility for breeding purposes?

- ☐ **No**
- ☐ **Yes**

4. Have one or more does been transferred into/out of this facility for breeding purposes?

- ☐ **No**
- ☐ **Yes**

5. Are cervids artifically inseminated at this facility?

- ☐ **No**
- ☐ **Yes**

How many? **By Who?** **Cervid Semen Supplier(s):**

6. Cervid Breeding Comments:

CURRENT FACILITY AND FENCE CONDITIONS SECTION

1. How many pens are at the facility?

2. Fence heights at facility (feet and inches):

Maximum Height: **Minimum Height:**

3. Fence types used at facility:

- ☐ **Chain Link**
- ☐ **Woven Wire**
- ☐ **Wood**
- ☐ **Other**

Other Description:

4. Number of ingress/egress faults:

5. Are the fence perimeters inspected monthly?

- ☐ **No**
- ☐ **Yes**

6. Have free-ranging cervids been within this facility?

- ☐ **No**
- ☐ **Yes**

If Yes, how were they removed?:

7. Facility and Fence Conditions Comments:

CERVID RECORDS SECTION

1. How are captive cervid farm records stored?

☐ **Electronic** ☐ **Paper**

2. Where are captive cervid farm records kept?

3. Have you been asked to alter captive cervid related records?

☐ **No**
☐ **Yes**

Alteration Details:

4. Have you ever altered your captive cervid related records?

☐ **No**
☐ **Yes**

Alteration Details:

5. What unlicensed captive cervid facilities in this area are you aware of?

6. Cervid Records Comments:

INSPECTION TEAM INFORMATION SECTION

1. Audit team member providing audit packet to owner/representative:

2. Owner/representative receiving audit packet:

3. Were biosecurity measures and procedures followed by the inspection team?

- ☐ **No**
- ☐ **Yes**

4. Is this facility in full compliance with the laws governing captive cervid facilities?

- ☐ **No**
- ☐ **Yes**

5. Inspection Team Member 1:

6. Inspection Team Member 2:

7. Inspection Team Member 3:

8. Inspection Team Member 4:

9. Inspection Team Member 5:

10. Final Comments:

Exhibit 2. Inspection Procedures Protocol

Inspection procedures guidelines

I. Pre-inspection

- Make contact with owner/representative
    1. Set up time and location of inspection. (Inspections will be scheduled during normal business hours Mon.– Fri unless extenuating circumstances exist)
    2. Discuss entrance procedures.
    3. Attempt to get a general idea of facility size, terrain etc.
    4. Notify owner/operator that all business, animal inventory and health testing records are to be available for inspection at the facility.
    5. Determine if facility is pre-act 190 (needed to determine which fence regulations are in force)
- Notify local Conservation Officer of appointment date and time, coordinate transportation needs. (carpool when possible)
- Review audit packet for completeness
- Check that necessary equipment is available and operational.
    1. Digital camera
    2. GPS unit
    3. PC, associated hardware and accessories
    4. Batteries / power converters
    5. Measuring staff and tape measure
    6. Portable copier and associated supplies
    7. Biosecurity supplies
    8. Other protective clothing (hip boots, waders etc.)

II. Team arrival

- All employees will have official identification; LED staff are to be in uniform.
- Make contact with owner/representative at prearranged location.
    1. Restate Audit intentions
    2. Discuss inspection procedures
    3. Inquire as to any biosecurity concerns
- State vehicles need to remain outside of animal enclosures
- Denial of access -- refer to Audit Team Emergency Contingency Plan
- Biosecurity in effect at the time Audit Team exits their vehicles (disinfect boots/ utilize other protective clothing as warranted)
- All precautions will be taken to prevent pathogen exchange between facilities

III. Fence inspection

- Teams are not to enter animal enclosures.
- Inspections to be completed on foot.
- Owner/representative will be invited to accompany the team.
- Fence boundaries will be geographically mapped and boundary coordinates recorded.
- Document fence faults with:

1. Photo's (record pictures taken on photo log)
2. GPS coordinates
4. Flag fence problems with surveyor's tape/number flag for future reference
5. Note any evidence of cervid movement under/through fence defects.

- While checking the fencing teams will conduct an informal inspection of the facilities inventory without disturbing any animals. Numbers and species to be noted.
- If animals exhibiting symptoms of disease are observed, the Michigan Department of Agriculture will be notified
- All fence deficiencies will be noted on the Facility Inspection Report

IV. Records inspection

- Review the following facility records
  1. Monthly and annual fence inspection records
  2. Cervid movement (purchase/sales) records
  3. TB/CWD testing records
  4. Animal identification records
  5. Death records
  6. Summary inventory reports

V. Species Inventory

- Teams are not to enter animal enclosures.
- Animal type and number will be estimated by the owner/representative and compared with existing records.
- Comparisons can be made with animals observed during fence inspection.

VI. Audit Questionnaire

- It is important that teams complete the Audit Questionnaire in its entirety.

VII Team departure

- Biosecurity
  1. Boots disinfected
  2. Any other protective clothing shall be disinfected, or else properly disposed of on the premises.
  3. If vehicles or other equipment for some reason come in contact with animals or animal areas, that equipment must be disinfected prior to entering another facility.
- Review deficiencies with owner/representative.

- Give owner/representative a copy of inspection report with timeline for the correction of noted deficiencies.
- Schedule reinspection if necessary.

VIII Post inspection

- <u>Within 48 hours of audit</u>:
  1. FAX questionnaire and photo log to Wildlife Division, Lansing [517-373-9566]

- Within five calendar days of audit:
    1. Make photocopies of questionnaire and photo log
    2. Mail original questionnaire, photo log and Goldenrod copy of Inspection Report to:
        Mr. Jim Janson
        MDNR Wildlife Division
        PO Box 30444
        Lansing, MI 48909-7944
    3. Upload digital photos to Lansing server using the UpLoadCWDphotos.bat on the desktop

- Within two weeks:
    1. Lansing Staff will mail a copy of Audit Questionnaire to Owner/Representative

- If reinspection is necessary to ensure correction of deficiencies, within five calendar days of reinspection:
    1. Mail a reinspection summary, noting if appropriate corrections were taken or if continued deficiencies were turned-over-to the local wildlife biologist and conservation officer for follow-up inspection, to:
        Mr. Jim Janson
        MDNR Wildlife Division
        PO Box 30444
        Lansing, MI 48909-7944

Exhibit 3. Agenda for training sessions

WILDLIFE DIVISION - LAW ENFORCEMENT DIVISION

Risk-Based Audit Training of Privately Owned Cervid Facilities in Michigan

RAM Conference Center, Roscommon

June 7, 8, 9 2004

AGENDA
TRAINING GROUP 1

Day 1 - Monday, June 7, 2004 (Upper Classroom)

Time	Topic	Presenter
8:00 – 8:30 am	Introduction – Overview ♦ Goal ♦ Executive Order 2004-3 ♦ Final Report – MI Chronic Wasting Disease Task Force ♦ Flexibility for Supervisors	Dr. Bill Moritz, WLD Alan Marble, LED
8:30 – 9:00	CWD Biology/Science	Dr. Dan O'Brien, WLD
9:00 – 9:10	***Break***	
9:10 – 9:30	Facility Risk Assessment ♦ Prioritization of audit facilities ♦ Movement of Animals	Dr. Shelli DuBay, WLD
9:30 – 10:00	How to conduct yourself around captive cervid ♦ Differences with cattle ♦ Animal Industry ♦ CWD Testing – MI Dept. of Ag. Accreditation Program ♦ TB Protocol for slaughter Examination of white-tailed deer/elk 2000 ♦ MDA requirements for captive cervid facility ♦ Health inspection records	Dr. Mike Vanderklock, MDA Mr. Alex Draper, Michigan Deer and Elk Farmer's Association
10:00 – 10:10	***Break***	
10:10 – 10:45	Biosecurity ♦ When DNR is on Private Property ♦ Virus, bacteria on boots ♦ Disinfectant, etc.	Dr. Steve Nederveld, MDA
10:45 – 10:55	***Break***	
10:55 – 12:00	Field Protocol and Audit and Questionnaire ♦ Procedures ♦ Questionnaire ♦ Immediate response ♦ Q & A	Wade Hamilton, LED
12:00 – 1:00	***Lunch***	
1:00 – 2:00	GPS ♦ GPS Use ♦ Set up parameters ♦ Software and instruction on raw data ♦ Backup plan if GPS unit fails ♦ Maps and other resources	Marshall Strong, Tom Oliver, Kevin Gardiner, WLD
2:00 – 2:10	***Break***	
2:10 – 2:45	Digital Camera Documentation ♦ Standards for photos ♦ Pixel size ♦ Numbering system (identify using Captive Cervid Permit No.) ♦ Log sheet ♦ GPS location of photos ♦ Photo storage and uploads	Jeremy Premo, LED Melinda Cosgrove, WLD

Revised: May 28, 2004

AGENDA - TRANING GROUP 1

Day 1 – Monday, June 7, 2004 (continued)

Time	Topic	Presenter
2:45 – 3:15	Confrontational contingency plan ♦ Definitions ♦ Authority ♦ Safety	Bruce Borkovich, LED
3:15 – 3:25	***Break***	
3:25 – 4:30	Wisconsin Presentation ♦ Wisconsin Audit ♦ Customer Service ♦ Q & A	John Welke, CO Investigator Wisconsin, LED
4:30 – 5:15	Fence Inspection Requirements	Ron Utt, LED
5:30 – 6:30	***Dinner***	
6:30 – 8:30 pm	Legal Procedures - Upper Classroom (continued) ♦ Animal Industry Act 1988 ♦ Act 190 of 2000 – Privately Owned Cervidae Producers Marketing Act ♦ Requirements ♦ Records ♦ Inspections ♦ Inventory	Bruce Borkovich, LED
8:30 – 9:00	Summary ♦ Questions and Answers ♦ Time Reporting ♦ Purchasing Items	Dave Purol, LED Dave Dominic, WLD

WILDLIFE DIVISION - LAW ENFORCEMENT DIVISION

Risk-Based Audit Training of Privately Owned Cervid Facilities in Michigan

TRAINING GROUP 1

Day 2 – Tuesday, June 8, 2004 (Field Visit)

Time	Topic	Presenter
8:00 – 9:00 am	GPS (across street in open field) ♦ On-site exercise ♦ Download points	Marshall Strong, Kevin Gardiner, WLD
9:00 - 10:00	Meet to carpool to Captive Cervid Farm location (breakout into two groups) ♦ Travel to Cervid Facility (Mt. Pleasant, Isabella County – Bruce Borkovich or Atlanta – Ron Utt) ***(Pick up sack lunches from main lobby)***	Travel to site
10:00 – 3:00	Field Trip to Captive Cervid Farm ♦ Landowner on site during the visit ♦ Questionnaire - fence and record inspections ♦ Practice with GPS	Bruce Borkovich Ron Utt, LED Marshall Strong Kevin Gardiner, WLD

Exhibit 4. Michigan Department of Natural Resources – Law Enforcement Division

INSPECTION DATE
FACILITY NUMBER

PRIVATELY OWNED CERVIDAE FACILITY INSPECTION REPORT

Issued under the authority of Executive Order No. 2004-3 and Act 190 of P.A. 2000.
Failure to comply with the requirements of Act 190 may result in fines, imprisonment, or both.

Owner Name	Business/Facility Name	Class
Mailing Address	Facility Address	
City, State, ZIP	City, State, ZIP	
Owner Telephone	Facility Telephone	

Employee/Representative Name	County	Township	Town	Range	Section

	Satis-Factory	Unsatis-Factory	Comments
Fence Construction	☐	☐	
Material	☐	☐	
Condition	☐	☐	
Ground Edge	☐	☐	
Ground Level Openings	☐	☐	
Height (For Species)	☐	☐	
Gates	☐	☐	
Cervidae Records	☐	☐	
Animal Identification	☐	☐	
Fence Inspection Records	☐	☐	

Cervidae Species in Facility and Number (Indicate known or estimated)

☐ Whitetail _____ ☐ Fallow Deer _____ ☐ Sika Deer _____
☐ Elk _____ ☐ Reindeer _____ ☐ Red Deer _____
☐ Other _____

Additional Comments/Summary of Deficiencies

☐ Re-Inspection Required Re-Inspection Date and Time:

Inspection Team (print name)	Inspection Team Signatures	Owner Signature

Exhibit 5. Photo documentation log form

Facility Name Shady Acres **Facility Permit No.** 24731651

PLEASE PRINT LEGIBLY -This is the only record for this information.

Photo No. On Camera Camera filing system #	**Photo Documentation No.** Permit No.- Picture Number for that Facility	**GPS Coordinates** Location where picture was taken	**Photo Description** What picture is of and why taken	**Date**
IMG_001	24731651-1	43°44, 83°45	Facility Sign	05/24/2004
IMG_002	24731651-2	43°46, 83°45	Hole in fence, needs repair	05/24/2004
IMG_003	24731651-3	43°51, 83°50	Tree leaning on fence, needs to be removed	05/24/2004

Exhibit 6. Background letter to producers

STATE OF MICHIGAN

JENNIFER M. GRANHOLM GOVERNOR	DEPARTMENT OF NATURAL RESOURCES LANSING	REBECCA A. HUMPHRIES DIRECTOR

June 10, 2004

Dear Cervidae Facility Owner:

On April 15th Governor Jennifer Granholm issued Executive Order No. 2004-3, which transferred the responsibility for regulations and biosecurity of cervidae livestock facilities and operations from the Michigan Department of Agriculture (MDA) to the Michigan Department of Natural Resources (MDNR). The order calls for an immediate risk-based audit of privately-owned cervid facilities. The purpose of this audit is to determine if weaknesses exist in the program (in statute, and in the operating practices) which may facilitate the introduction of Chronic Wasting Disease (CWD) into either Michigan's privately-owned cervidae or wild cervidae species.

The MDNR will audit all Class III (Ranch) and Full Registration facilities beginning June 15, 2004. Facilities classified as Class I (Hobby) and Class II (Exhibition) have been assigned a lower risk-based priority and shall be audited as time permits.

The audit period runs from June 15 through September 30, 2004. Audit teams shall consist of MDNR wildlife biologists and conservation officers. Every effort shall be made to contact facility owners/operators in advance to schedule these on-site audits. The audit teams shall meet on-site with the owner or his/her designee to conduct this risk-based audit of the program.

The audit shall consist of the following elements:

-**facility records** to be reviewed will include those reports that document cervidae movements, herd inventory, CWD testing records as well as other records associated with the possession of privately-owned cervids. All relevant records, including your herd inventory and CWD testing records, shall be on site at the time of inspection.

-**animal type and number will be estimated** by owner/representative and compared with existing records. An informal estimate of animal numbers may be taken during the on-site audit.

-all **perimeter fences shall be inspected** by the audit team. The owner/owner's designee will be invited to accompany the team on the fence inspection. The fence boundary will be geographically mapped and boundary coordinates will be recorded. Potential "problem" areas will be photographed and those geographic coordinates recorded.

-if **animals exhibiting symptoms of disease** are noted, the audit team will immediately contact the Michigan Department of Agriculture.

-Each owner/representative will be surveyed about their operation. Animal type and number will be estimated by owner/representative and compared with existing records. Informal inspection by Conservation Officers and Wildlife Biologists, without disturbing animals, will be noted during fence inspection.

-a copy of the **inspection checklist** will be provided to the owner/representative at the conclusion of the audit. The checklist shall include a listing of facility deficiencies, with deadlines for correction that need to be addressed at the facility. A copy of **survey responses** will be mailed to the owner/representative within 2 weeks of the audit.

Biosecurity measures will be taken by members of the audit teams. All precautions will be taken to prevent pathogen exchange between facilities.

It is the intent of the MDNR to conduct the risk-based audit in a timely, professional manner that reasonably accommodates the facility owners' schedules and needs. Our goal is to assess the privately-owned cervidae program in order to identify problem areas needing correction to safeguard both wild and privately-owned cervidae from CWD.

Thank you in advance for your cooperation. Please feel free to contact Jim Janson, Wildlife Permit Specialist at 517-373-9329 if you have any questions.

Sincerely,

Alan Marble, Acting Chief
Law Enforcement Division
517-335-3427

William E. Moritz, Acting Chief
Wildlife Division
517-373-1263

Exhibit 7.

Garmin® GPS Field Collection - Reminder Sheet
(Specifically for Garmin® GPS unit models GPSMAP 76, 76s, 76sc)

By Marshall Strong, Kevin Gardiner, and Tom Oliver

Developed for use by participants of "Risk-Based Audit Training of Privately Owned Cervid Facilities in Michigan", June 7-9, 2004 at DNR RAM Center, Roscommon.

This document is provides reminders to GPS users about collecting and downloading data using the Garmin® GPSMAP76, GPSMAP76S, and GPSMAP76SC global positioning systems. Should you have problems with or questions about your GPS unit, contact Marshall Strong, Wildlife Division GIS/GPS and Mapping Specialist.

BEFORE DATA COLLECTION* – *Be sure the Garmin GPSMAP 76/76s/76sc unit is setup properly.

1) Navigate to the Main Menu (press **MENU** twice)
2) Select 'Setup', then push **ENTER**

3a) For GPSMAP 76 and GPSMAP 76S users:
   a. Use the **ROCKER** key to scroll to the 'Units' tab
      (i.) 'Elevation' and 'Depth' should be set to "Feet"
      (ii.) 'Direction Display' should be set to "Numeric Degrees"
      (iii.) Leave other settings as default
   b. Use the **ROCKER** key to scroll to the 'Location' tab
      (i.) 'Location Format' should be set to "hddd°mm.mmm"
      (ii.) 'Map Datum' should be set to "WGS 84"
      (iii.) 'North Reference' should be set to "True"
      (iv.) Leave other settings as default

Trimble GPS users can use the same settings through a different series of entries. For data collection, use PDOP = 6, SNR = 6

3b) For GPSMAP 76sc users:
   c. Use the **ROCKER** key to scroll to the 'Units' icon, then push **ENTER**
      (i.) 'Position Format' should be set to "hddd°mm.mmm" (ii.) 'Map Datum' should be set to "WGS 84"
      (iii.) 'Distance/Speed' should be set to "Statute" (iv.) 'Elevation/Vert. Speed' and 'Depth' should be set to "Feet"
      (v.) Leave other settings as default
   d. Push the QUIT key to go back to the 'Setup' menu, use the **ROCKER** key to scroll to the 'Heading' icon, then push **ENTER**
      (i.) 'Display' should be set to "Cardinal Letters" (ii.) 'North Reference' should be set to "True"
      (iii.) Leave other settings as default

4) Press the PAGE key twice to return to the map page. You are now ready to collect data!

ON-SITE DATA COLLECTION* – *Turning the Track Log on/off, collecting data

1) Upon arrival at the point of beginning, navigate to the Main Menu (press **MENU** twice)
2) Select 'Tracks', then push **ENTER**

3a) For GPSMAP 76 and GPSMAP 76S users:
   a. Select "Setup Track Log", then push **ENTER**
      i. 'Recording' should be set to "Stop When Full"
      ii. 'Record Method' should be set to "Auto"
      iii. 'Interval' should be set to "Most Often"

3b) For GPSMAP 76sc users:
   b. Use the **ROCKER** key to select Track Log "On", then push **ENTER**
   c. Use the **ROCKER** key to select 'Setup', then push **ENTER**
      i. Uncheck 'Wrap When Full'
      ii. 'Record Method' should be set to "Auto"
      iii. 'Interval' should be set to "Most Often"

3) Walk the course – keep an eye on the accuracy on GPS information page (screen pg1)
      i. Ideally, accuracy should remain = 50ft (15m) - - best is under 20-25ft (6-7m)

5) When you reach the point of beginning, save the track and turn the track log off
   a. For GPSMAP 76sc users:
      i. On the 'Tracks' page, use the **ROCKER** key to select 'Save' and push **ENTER**
      ii. When prompted to save the entire track, select "Yes"
      iii. Assign the track a name (it may be useful to assign the permit number as the name)

******** Contingency plans if GPS unit fails ********

1) If your GPS unit fails, it will be necessary to record your track (the fence line) on paper. This is best accomplished using an aerial photo as a backdrop, as it provides the greatest amount of landscape detail. DO NOT write on original photos. If the GPS unit fails (low batteries, loss of satellite reception, etc.) create a hand-draw map using a known location (road intersection with known distance to start point, etc.) and try to list the approximate distances along the sides of the fence. You can later re-copy the hand-drawn map onto a photocopy of aerial photography, if desired. Plat maps can also be used as a backdrop in those instances where aerial photos are not available.

***AFTER DATA COLLECTION* - Download the data from the GPS unit to a PC or laptop computer**

1) Your training packet contains information on how to acquire, install, and run the necessary software. Be sure to send the data to Lansing as soon as possible. Email shapefiles (all parts) to Marshall Strong at *strongml@michigan.gov*. Be sure the filename = the permit number!
2) If you created hand-drawn map, be sure to check its quality. Can the boundary be seen? Fax hand-drawn maps to Marshall Strong at (517) 373-6705. Be sure to include your name and the permit number. IMPORTANT - Retain a hardcopy for your records, as questions or problems may arise in the future.

Exhibit 8. An aerial map of a CP-OC facility showing the location of its perimeter fence

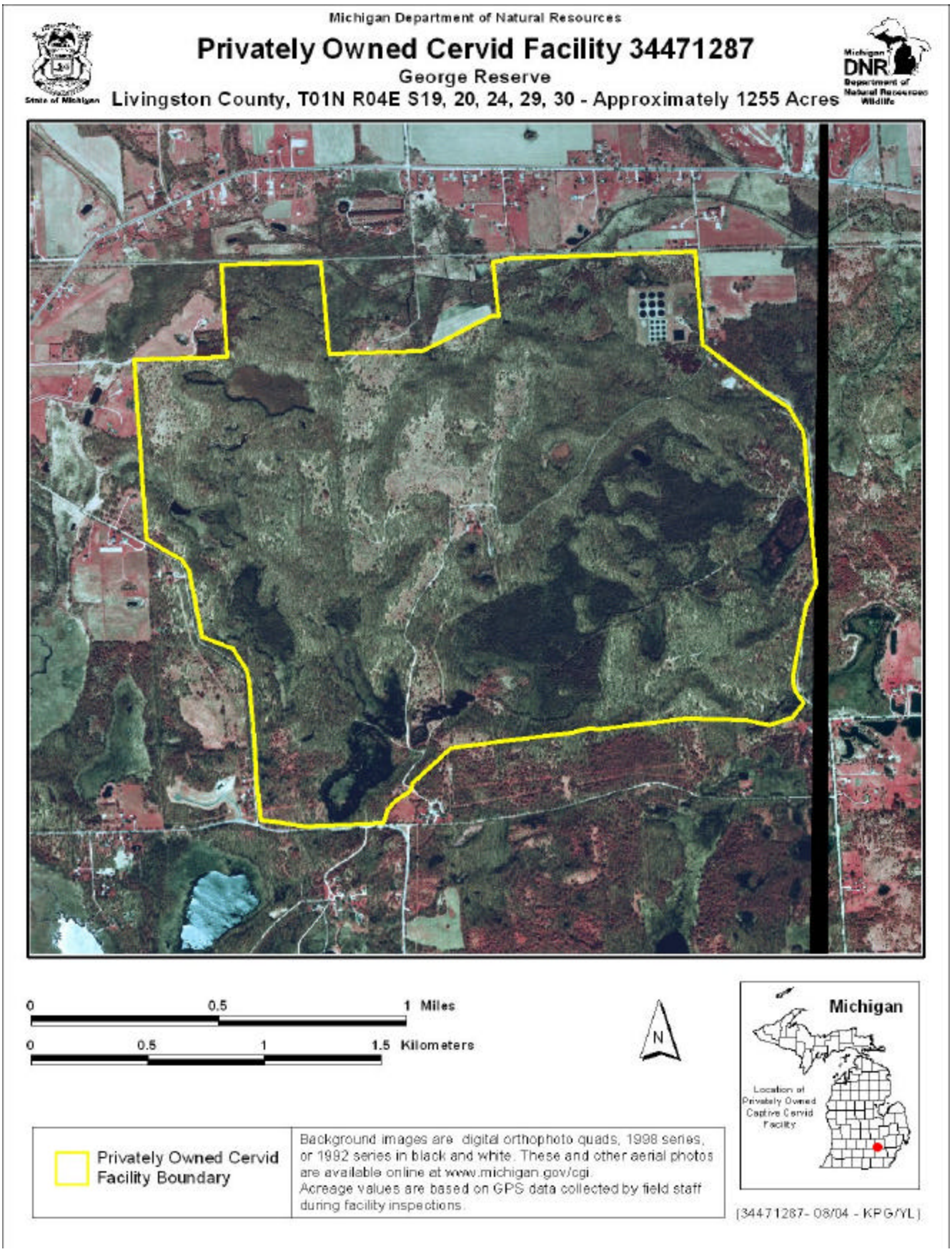

Exhibit 9. Sample summary weekly report spreadsheet

Facilities	# Hobby	# Exhibition	# Ranches	# Full regis	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Total to Date
Non-compliant													
EUPMU			1	3	1					2	1		4
NEMU	1		8	13		4	1	1	5	4	3	4	22
NWMU			4	16	1	2		4	6	3	1	2	20
SBMU	1		13	38	8	4	8	12	4	2	11	2	52
SCMU	2	1	3	20	2	2	1	4	6	3	4	4	26
SEMU	1		5	13			3	1	2	7	3	3	19
SWMU			1	9				1	3	2	4		10
WUPMU			2	3		1	2		1			1	5
Non-compliant total	5	1	37	115	12	13	15	23	27	23	27	16	158
Compliant (or unknown)													
EUPMU			0	4	1		1		1			1	4
NEMU	1	1	23	19	2	4	2	7	11	6	8	4	44
NWMU	3		28	53	6	4	24	9	2	14	7	13	84
SBMU	1		4	20	5	3	6	5		1	3	1	25
SCMU			9	22	1	2	4	3	4	8	3	5	31
SEMU	1	1		39	3	6	3	2	15	8	2	2	41
SWMU	1		8	35	3	1	1	9	14	8	4	4	44
WUPMU			6	10			5	3	2	4	1	1	16
Compliant/unknown total	7	2	78	202	21	20	46	38	49	49	28	31	289
MU totals													
EUPMU	0	0	1	7	2	0	1	0	1	2	1	1	8
NEMU	2	1	31	32	2	8	3	8	16	10	11	8	66
NWMU	3	0	32	69	7	6	24	13	8	17	8	15	104
SBMU	2	0	17	58	13	7	14	17	4	3	14	3	77
SCMU	2	1	12	42	3	4	5	7	10	11	7	9	57
SEMU	2	1	5	52	3	6	6	3	17	15	5	5	60
SWMU	1	0	9	44	3	1	1	10	17	10	8	4	54
WUPMU	0	0	8	13	0	1	7	3	3	4	1	2	21
Grand Total	12	3	115	317	33	33	61	61	76	72	55	47	447
Total Registered as of 5/17/04	166	33	141	398									738
% of Class Non-compliant	42	33	32	36									
% of Total Inspected to Dat	7	9	82	80									61

Appendix B
Audit Inspection Questionnaire Results

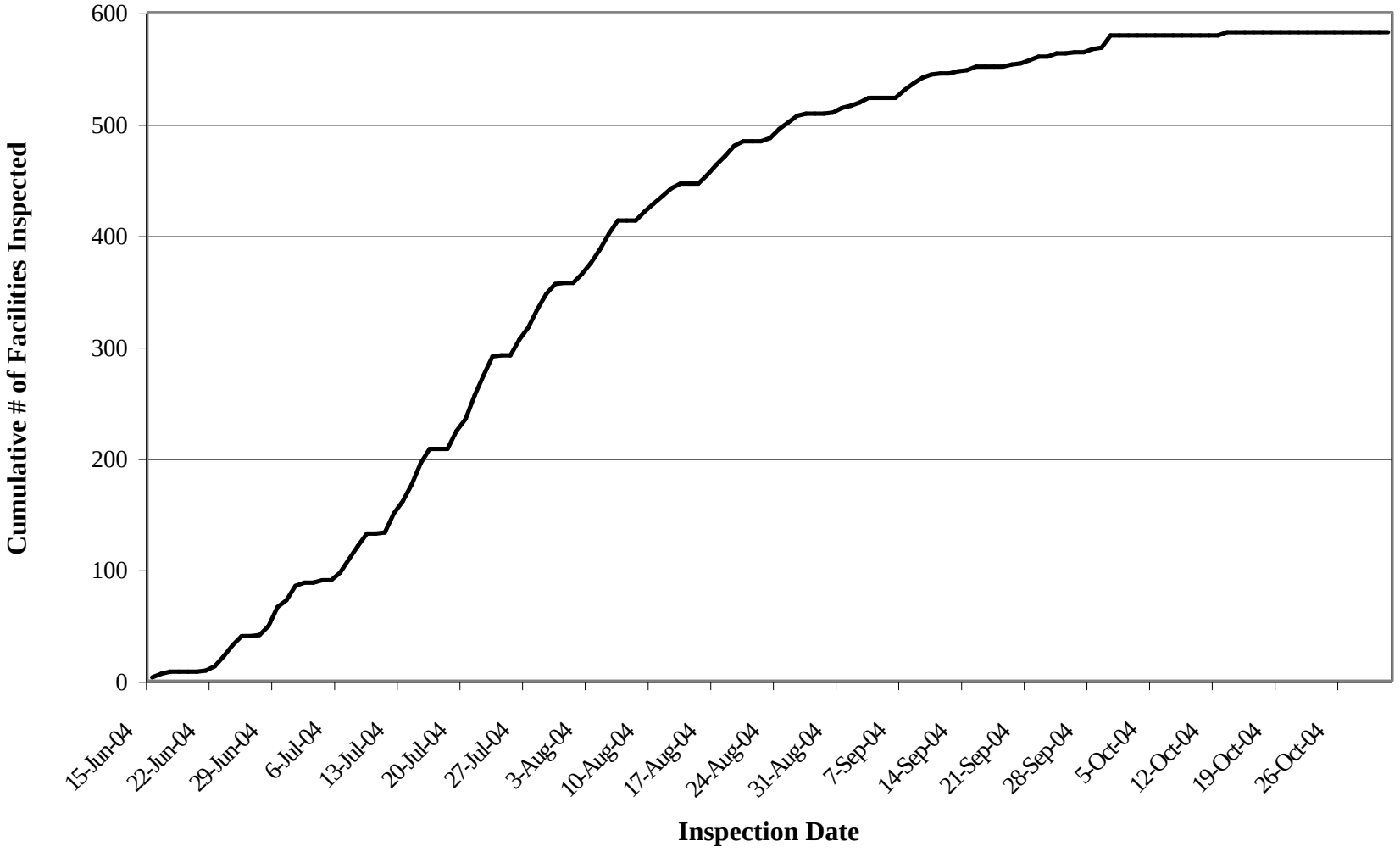

Figure 1. Cumulative curve showing progress of inspections on all classes of Michigan C/P-OC facilities from June 15, 2004 to October 26, 2004.

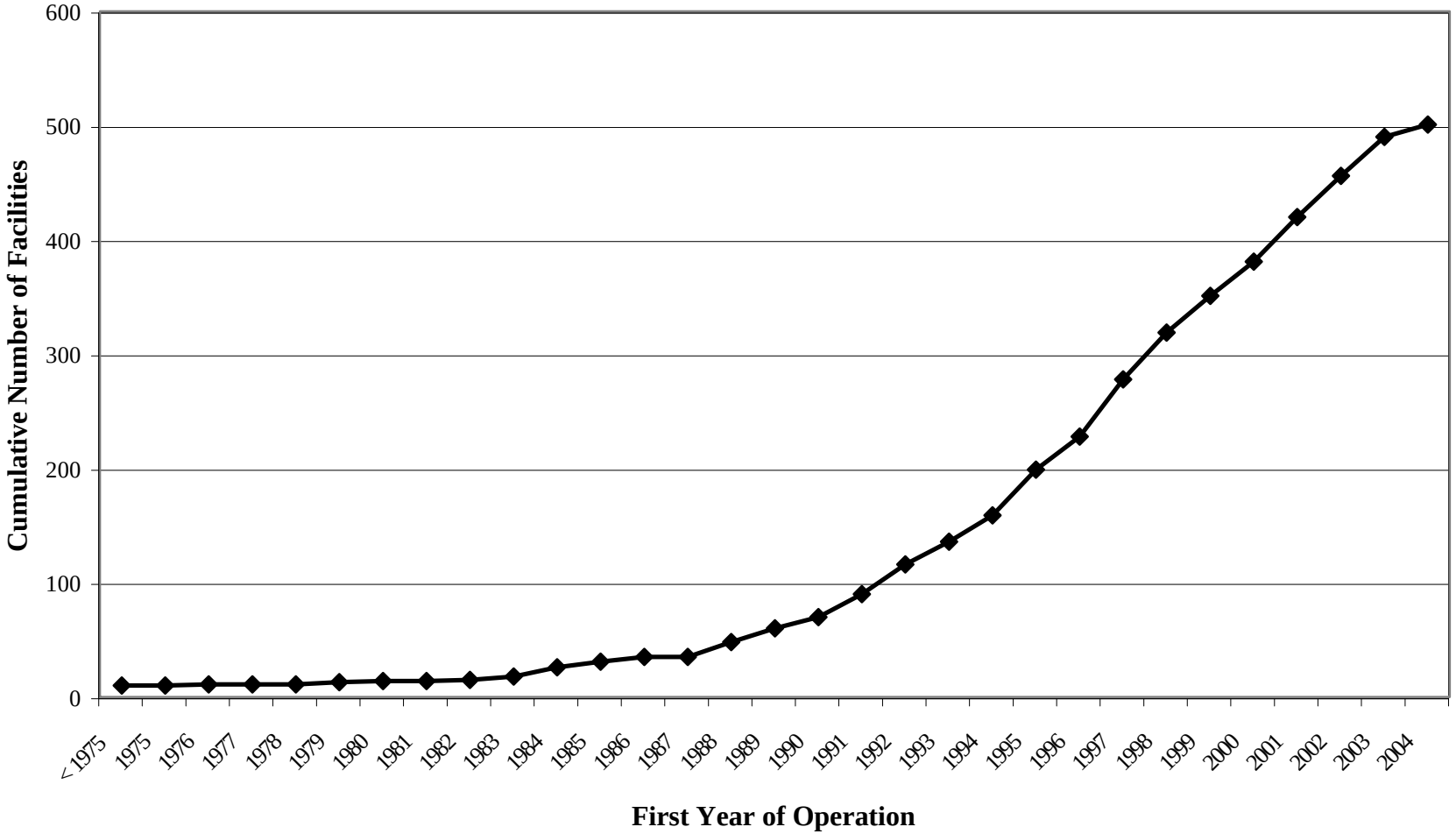

Figure 2. Cumulative curve showing first year of operation of all active Michigan C/P-OC facilities inspected during 2004.

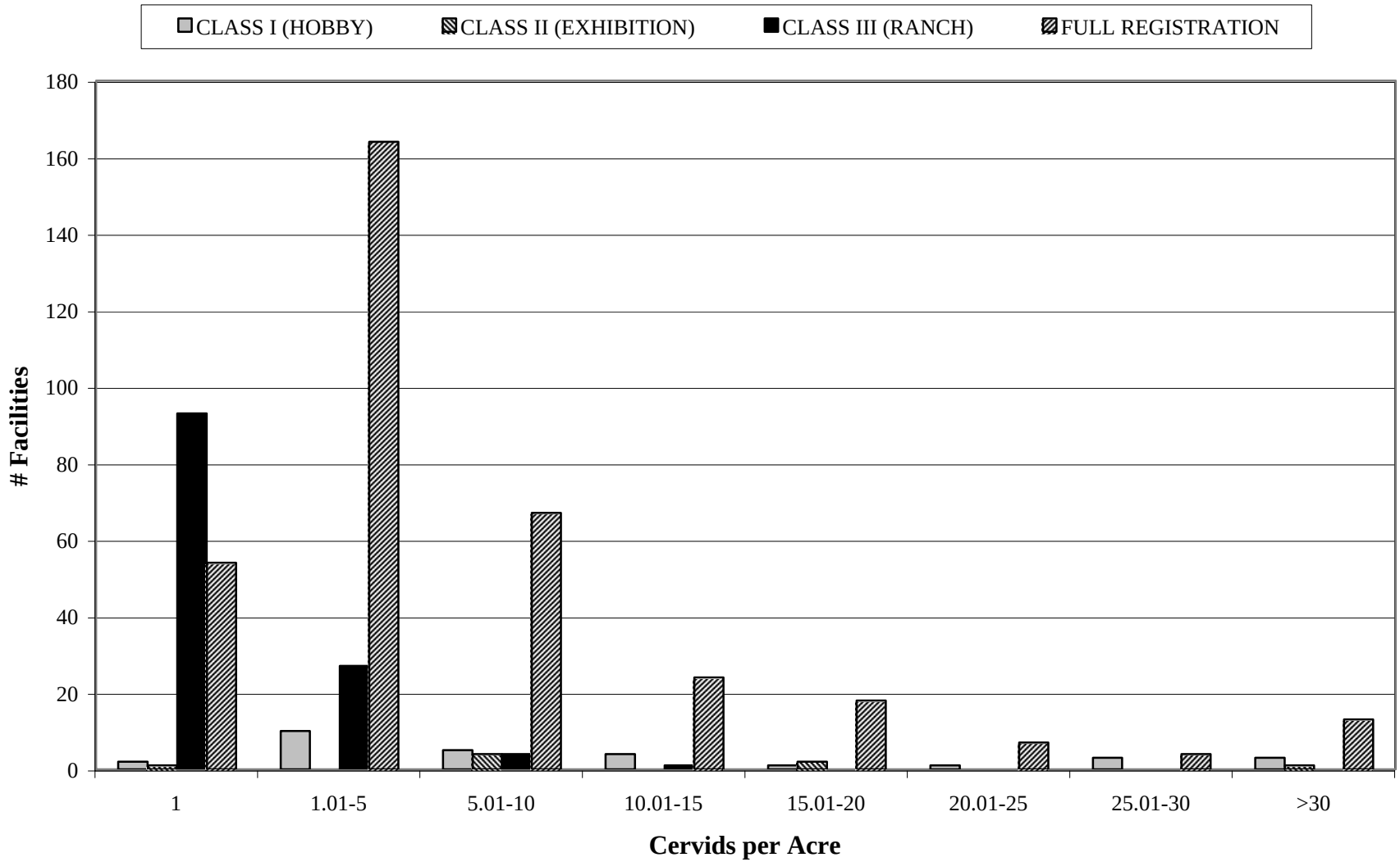

Figure 3. Density of C/P-OC on all classes of active Michigan C/P-OC facilities at the time of inspection. (At the time of writing, area data were missing from 2 facilities.)

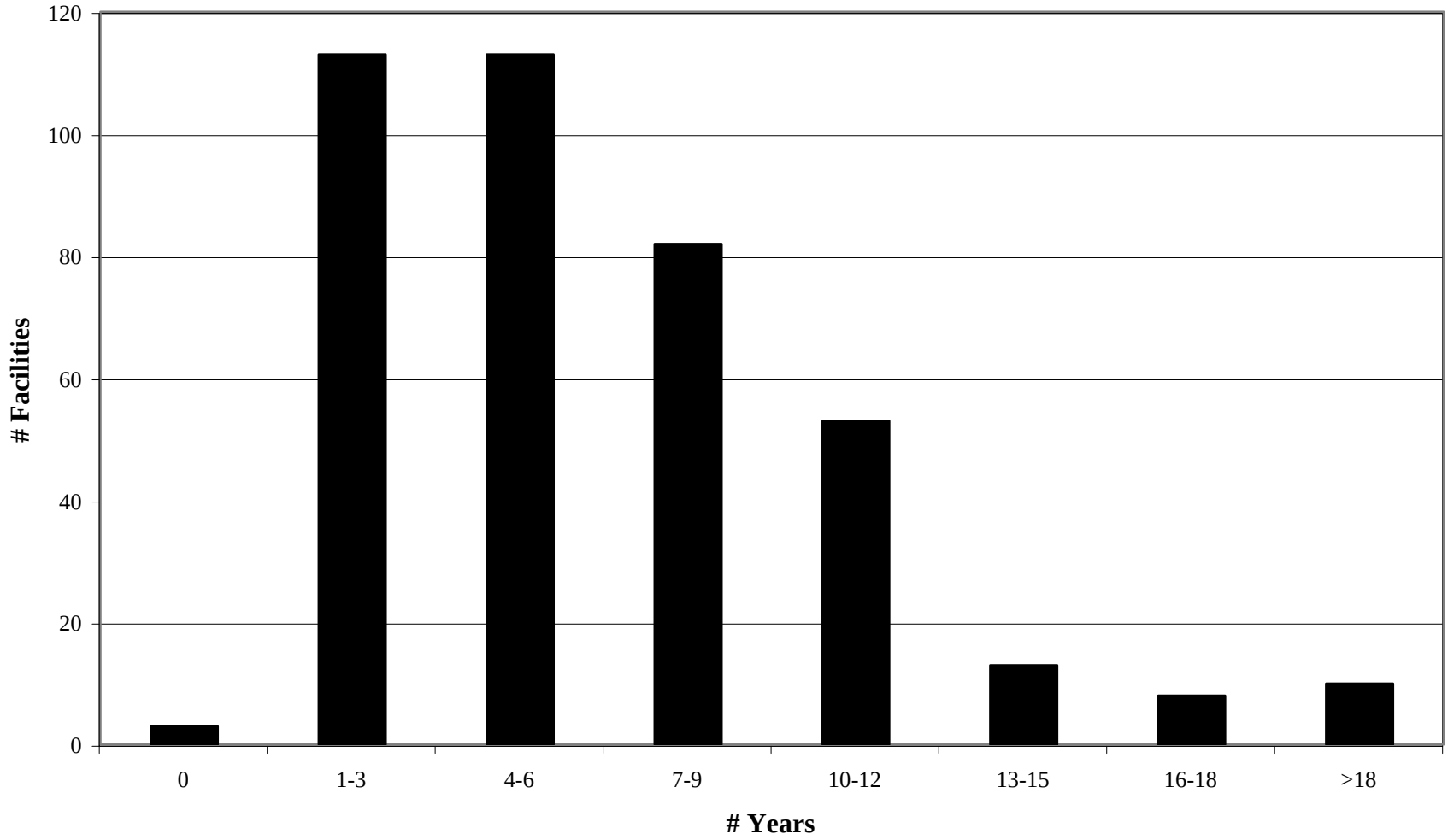

Figure 4. Number of years that veterinarians have been servicing active C/P-OC facilities in Michigan.

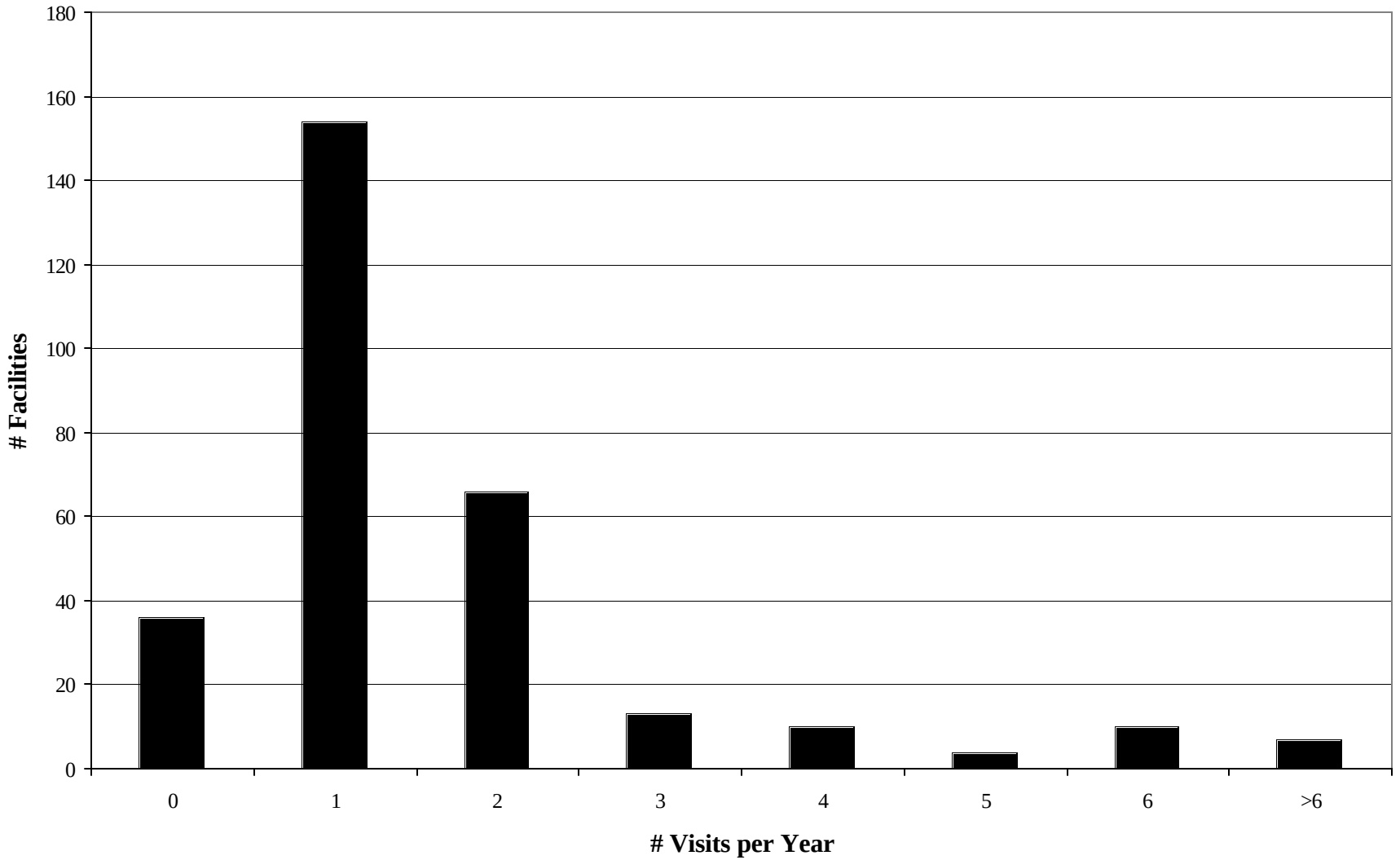

Figure 5. Number of veterinarian visits per year on inspected and active C/P-OC facitilies in Michigan.

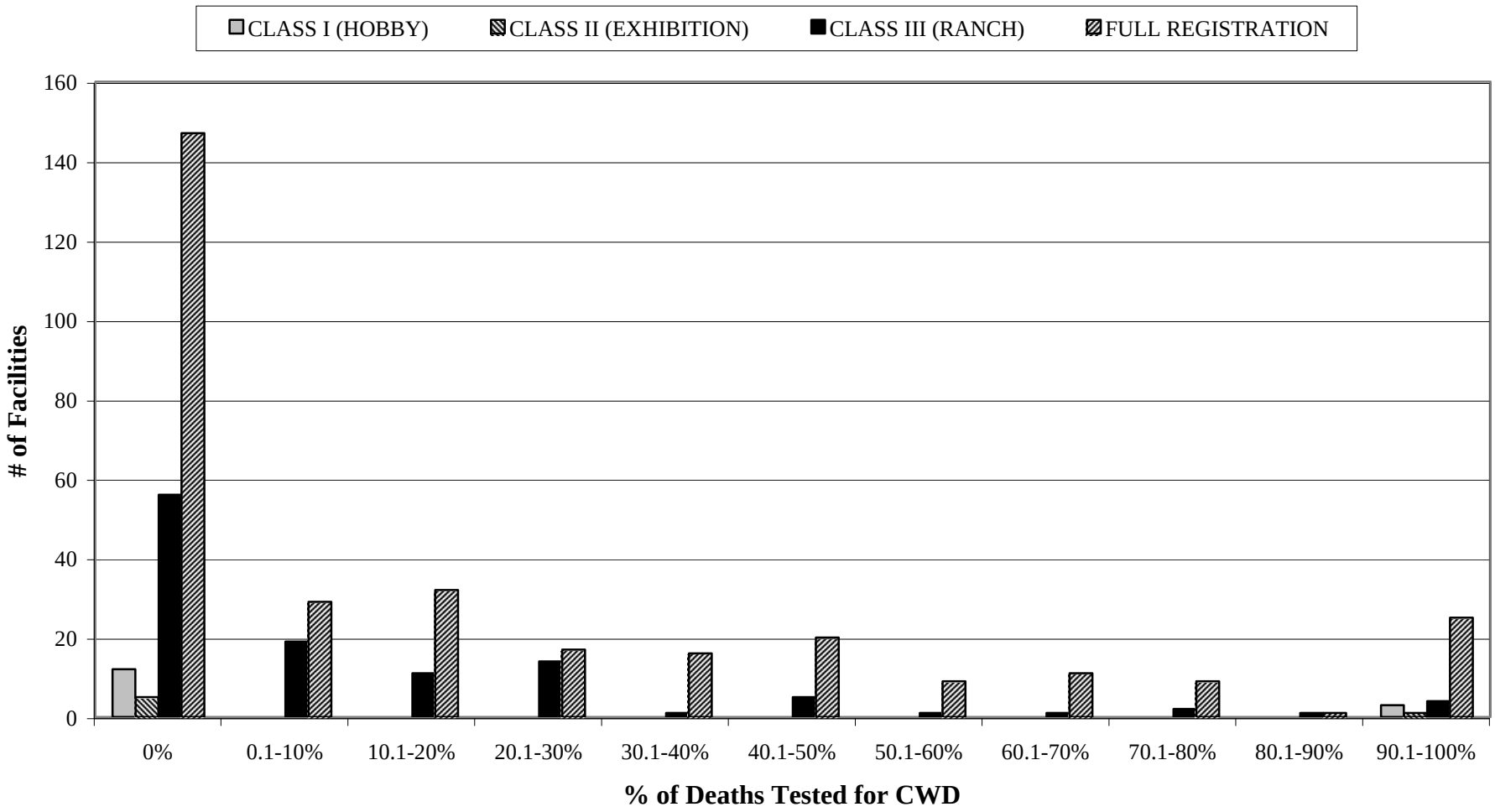

Figure 6. Percentage of cervid deaths tested for CWD in last 4 years on inspected and active C/P-OC facilities in Michigan. Facilities reporting more cervids tested for CWD than deaths were excluded from analysis.

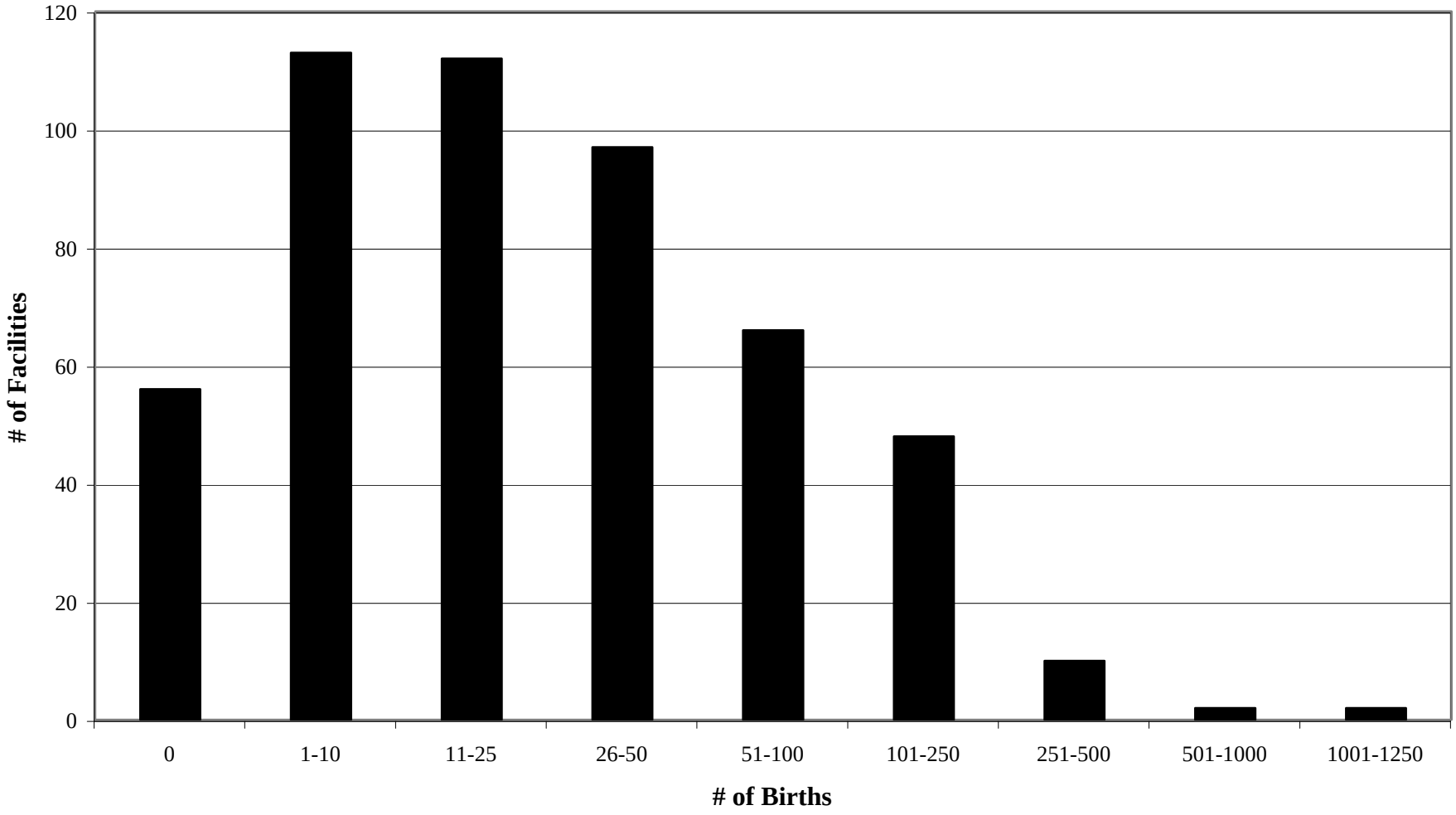

Figure 7. Number of cervid births occuring at all active and inspected C/P-OC facilities in Michigan during the last 3 years.

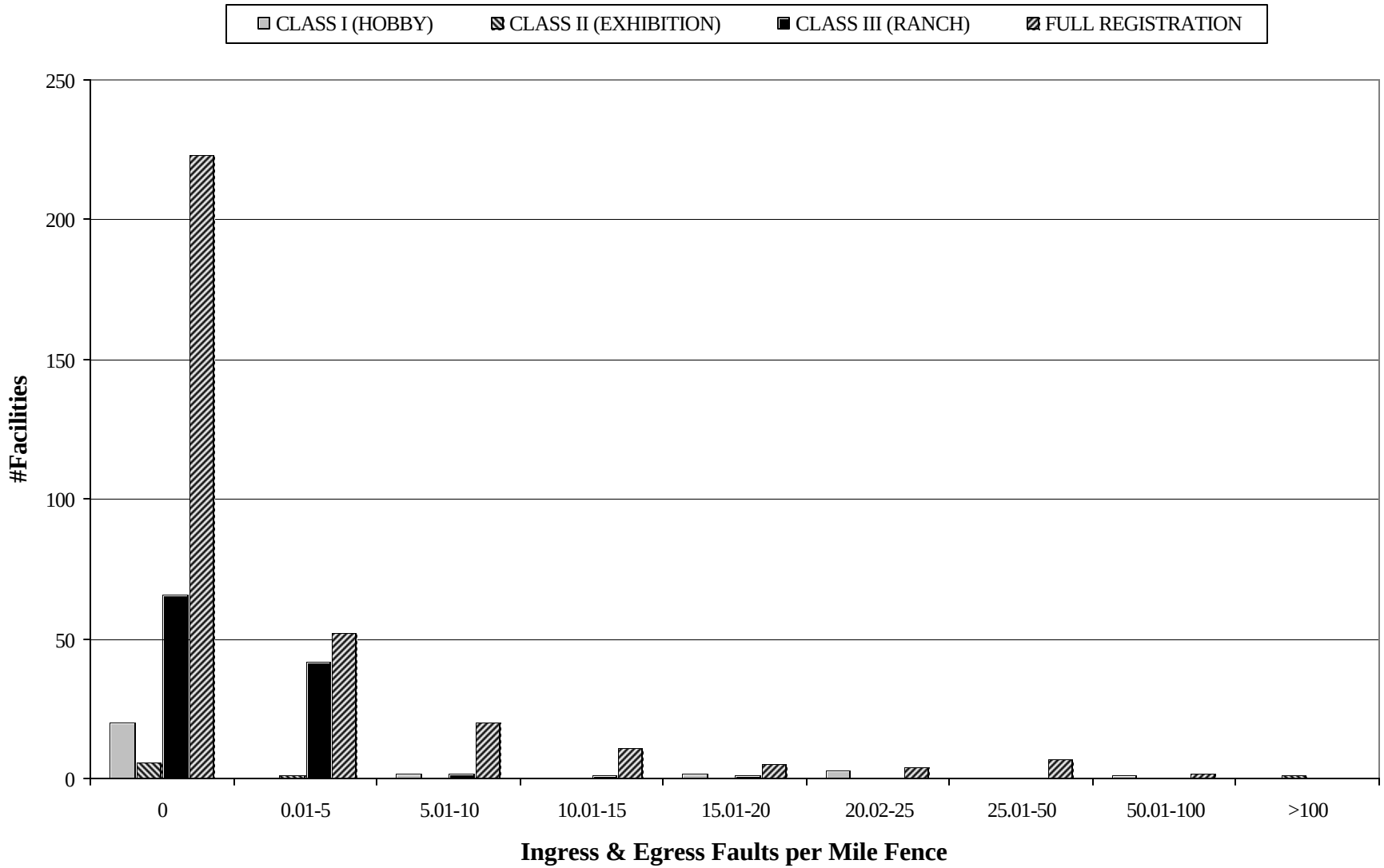

Figure 8. Number of ingress and egress faults per mile of perimeter fence at inspected and active C/P-OC facilities at the time of inspection. (At the time of writing, fence length data were missing from 2 facilities.)

Table 1a. Number and class of C/P-OC facilities showing MDA registration status, MDNR inspection goals, and complete inspections conducted from June 1 - Oct. 26, 2004. After inspections were complete, facilties were defined as active or inactive.

Facility Class	MDA Registration	Registration Complete	Inspection Goal	Inspections Completed	Inspected and Active
CLASS I (HOBBY)	166	86	33	35	29
CLASS II (EXHIBITION)	33	17	7	9	8
CLASS III (RANCH)	142	103	142	142	125
FULL REGISTRATION	399	300	399	398	344

Table 1b. Number and Wildlife Management Unit of C/P-OC facilities showing showing MDA registration status, MDNR inspection goals, and complete inspections conducted from June 1 - Oct. 26, 2004. After inspection was complete, facilties were defined as active or inactive.

WMU	MDA Registration	Registration Complete	Inspection Goal	Inspections Completed	Inspected and Active
EUP	14	13	13	13	11
NE	97	70	75	76	66
NW	145	116	124	124	107
SB	119	57	90	90	73
SC	109	75	83	84	77
SE	98	71	74	74	67
SW	120	73	91	92	76
WUP	38	31	31	31	29

Table 2a. Number and class of inspected and active Michigan C/P-OC facilities that are linked to other C/P-OC facilities within Michigan and outside of Michigan due to shared ownership, along with the number of facilities where cervids were either purchased or sold at auctions during the last 4 years.

Facility Class	Own Facilities Inside MI	Own Facilities Outside MI	Purchased/Sold Cervids at Auction	Inspected and Active Facilities
CLASS I (HOBBY)	1			29
CLASS II (EXHIBITION)	1		1	8
CLASS III (RANCH)	14	2	9	125
FULL REGISTRATION	38		56	344

Table 2b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that are linked to other C/P-OC facilities within Michigan and outside of Michigan due to shared ownership, along with the number of facilities where cervids were either purchased or sold at auctions during the last 4 years. Sample size of Class I and Class II facilities was too small for analysis at the WMU level.

WMU	Own Facilities Inside MI	Own Facilities Outside MI	Purchased/Sold Cervids at Auction	Inspected and Active Facilities
EUP			1	10
NE	6		7	62
NW	12		16	103
SB	9		10	67
SC	6	1	7	68
SE	8		7	61
SW	6		15	71
WUP	5	1	2	27

Table 3a. Number and class of inspected C/P-OC facilities showing state of origin of cervids. An "*" denotes states and provinces where CWD has been found in either free-ranging or C/P-O cervids.

Facility Class	AB*	AK	CA	CO*	IA	IL*	IN	MB	MI	MN*	MO	NC	ND	OH	ON	OR	PA	QC	SD*	SK*	TX	WI*	Inspected Facilities
CLASS I (HOBBY)							2		25			1		2									35
CLASS II (EXHIBITION)									7					1									9
CLASS III (RANCH)	2			1	1		1	1	113	2				1	1		1					6	142
FULL REGISTRATION	3	1	1		3	2		1	332	1	5		1	6	4	1	2	1	2	2	1	15	398

Table 3b. Number and Wildlife Management Unit of inspected C/P-OC facilities showing state of origin of cervids. An "*" denotes states and provinces where CWD has been found in either free-ranging or C/P-O cervids. Sample size of Class I and Class II facilities was too small for analysis at the WMU level.

WMU	AB*	AK	CA	CO*	IA	IL*	IN	MB	MI	MN*	MO	NC	ND	OH	ON	OR	PA	QC	SD*	SK*	TX	WI*	Inspected Facilities
EUP									12							1							11
NE	3				1				63		1			1	1				1			3	69
NW			1		1				103					1	1		1	1			1	4	120
SB									81						1		1					1	84
SC							1	1	69	1	1	1		3	1							3	74
SE	1				1			1	60		1			3						1		2	68
SW		1			1	2	2		66		1			2	1				1			2	85
WUP	1			1					23	2	1		1				1			1		6	29

Table 4a. Number and species of cervids held in all classes of inspected and active C/P-OC facilities at the time of inspection. Species marked with an "*" are thought to be susceptible to CWD.

Facility Class	Elk*	Fallow Deer	Mule Deer*	Red Deer*	White-tailed Deer*	Other Species	Inspected and Active Facilities
CLASS I (HOBBY)	80	0	0	0	96	12	29
CLASS II (EXHIBITION)	0	4	0	1	19	47	8
CLASS III (RANCH)	1221	801	0	238	15929	205	125
FULL REGISTRATION	2728	482	0	372	9932	326	344

Table 4b. Number and species of cervids held on inspected and active Class III and Class IV C/P-OC facilities in all Wildlife Management Units at the time of inspection. Species marked with an "*" are thought to be susceptible to CWD. Sample size of Class I and Class II facilities was too small for analysis at the WMU level.

WMU	Elk*	Fallow Deer	Mule Deer*	Red Deer*	White-tailed Deer*	Other Species	Inspected and Active Facilities
EUP	96			3	619		10
NE	747	81		16	5403	58	62
NW	847	214		109	10098	72	103
SB	520	288	0	206	3433	134	67
SC	420	296	0	87	1745	74	68
SE	454	249		21	1909	29	61
SW	461	105	0	104	1635	138	71
WUP	404	50		64	1019	26	27

Table 5a. Number and class of inspected and active C/P-OC facilities that co-mingled cervids, that co-mingled species susceptible to CWD, that have cervid species in adjacent pens, that have species susceptible to CWD in adjacent pens, where C/P-OC cervids have fenceline contact with free ranging cervids, and where supplements were fed to cervids.

Facility Class	Co-mingle	Co-mingle Susc. Spp.	Adjacent Pens	Adjacent Susc. Spp.	Fenceline Contact	Feed Supplements	Inspected and Active Facilities
CLASS I (HOBBY)	1	1	2	1	27	28	29
CLASS II (EXHIBITION)	1	0	1	0	7	7	8
CLASS III (RANCH)	50	41	26	15	118	119	125
FULL REGISTRATION	41	16	83	29	323	336	344

Table 5b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilties that co-mingled cervids, that co-mingled species susceptible to CWD, that have cervid species in adjacent pens, that have species susceptible to CWD in adjacent pens, where C/P-OC cervids have fenceline contact with free ranging cervids, and where supplements were fed to cervids. Sample sizes for Class I and II facilities were too small for analysis at the WMU level.

WMU	Co-mingle	Co-mingle Susc. Spp.	Adjacent Pens	Adjacent Susc. Spp.	Fenceline Contact	Feed Supplements	Inspected and Active Facilities
EUP	1		2	1	8	9	10
NE	16	12	14	6	59	62	62
NW	20	11	26	10	95	100	103
SB	12	7	13	1	66	67	67
SC	14	10	13	4	67	65	68
SE	12	6	27	13	53	59	61
SW	8	4	10	6	68	69	71
WUP	8		4	3	25	24	27

Table 6a. Number and class of inspected and active C/P-OC facilities that individually marked no cervids, marked some cervids, marked all cervids, and used multiple types of identification for cervids. Thirteen facilities did not provide a relevant response regarding identification.

Facility Class	Mark No Cervids	Mark Some Cervids	Mark All Cervids	Use Multiple ID Types	Inspected and Active Facilities
CLASS I (HOBBY)	6	4	18	8	29
CLASS II (EXHIBITION)	1	0	7	3	8
CLASS III (RANCH)	22	27	69	43	125
FULL REGISTRATION	8	24	307	229	344

Table 6b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that individually marked no cervids, marked some cervids, marked all cervids, and used multiple types of identification for cervids. Thirteen facilities did not provide a relevant response regarding identification.. Sample sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	Mark No Cervids	Mark Some Cervids	Mark All Cervids	Use Multiple ID Types	Inspected and Active Facilities
EUP	2	0	8	6	10
NE	5	11	42	33	62
NW	7	5	88	58	103
SB	8	9	48	39	67
SC	2	16	48	38	68
SE	2	3	55	39	61
SW	2	5	64	43	71
WUP	2	2	23	16	27

Table 7a. Number and class of inspected and active C/P-OC facilities that use electronic ID, tattoos, ear tags, and other methods to mark individual cervids, and the number of facilities that mark cervids at 12 mos of age or younger.

Facility Class	Electronic ID	Tattoo	USDA Ear Tag	Other Ear Tag	Other Mark	No Mark	Mark by 12 mos	Inspected and Active Facilities
CLASS I (HOBBY)	0	0	15	14	1	10	13	29
CLASS II (EXHIBITION)	4	0	6	0	0	1	5	8
CLASS III (RANCH)	0	0	53	73	14	49	32	125
FULL REGISTRATION	13	7	256	261	42	32	224	344

Table 7b. Number and Wildlife Management Unit of inspected and active Class III and IV C/P-OC facilities that use electronic ID, tattoos, ear tags, and other methods to mark individual cervids, and the number of facilities that mark cervids at 12 mos of age or younger. Sample sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	Electronic ID	Tattoo	USDA Ear Tag	Other Ear Tag	Other Mark	No Mark	Mark by 12 mos	Inspected and Active Facilities
EUP	0	0	7	7	0	2	7	10
NE	2	1	38	37	9	16	20	62
NW	3	1	74	73	4	12	52	103
SB	2	2	49	42	7	17	47	67
SC	3	0	42	47	12	18	40	68
SE	1	1	38	49	9	5	39	61
SW	2	1	48	55	11	7	54	71
WUP	0	1	13	24	4	4	15	27

Table 8a. Number and class of inspected and active C/P-OC facilities that use electronic ID, tattoos, ear tags, and other methods to mark individual cervids during transport.

Facility Class	Electronic ID	Tattoo	USDA Ear Tag	Other Ear Tag	Other Mark	No Mark	Inspected and Active Facilities
CLASS I (HOBBY)	0	0	9	8	1	3	29
CLASS II (EXHIBITION)	2	0	4	0	0	1	8
CLASS III (RANCH)	0	0	22	28	18	10	125
FULL REGISTRATION	7	4	218	202	30	9	344

Table 8b. Number of inspected and active Class III and Class IV C/P-OC facilities by Wildlife Management Unit that use electronic ID, tattoos, ear tags, and other methods to mark individual cervids during transport. Sample sizes of Class I and Class II facilities were too small for analysis by WMU.

WMU	Electronic ID	Tattoo	USDA Ear Tag	Other Ear Tag	Other Mark	No Mark	Inspected and Active Facilities
EUP	0	0	7	4	0	1	10
NE	1	0	16	19	11	2	62
NW	2	0	61	55	5	6	103
SB	1	0	40	31	5	4	67
SC	2	0	38	29	10	7	68
SE	1	0	34	32	8	2	61
SW	2	2	46	49	5	0	71
WUP	0	2	11	19	5	1	27

Table 9a. Number and class of inspected and active C/P-OC facilites from which cervids have escaped, the number of escaped cervids, the number of facilities that have recovered escaped cervids, and the number of recovered cervids during the last 4 years. Also listed are the number of facilities that had marked cervids prior to escape and the number of facilities that isolated escaped cervids after recovery.

Facility Class	Facilities With Escapes	Escaped Cervids	Facilties With Recoveries	Recovered Cervids	Facilities Mark Escapes	Facilites Isolated Recoveries	Inspected and Active Facilities
CLASS I (HOBBY)	6	9	5	8	4	1	29
CLASS II (EXHIBITION)	2	2	2	3	1		8
CLASS III (RANCH)	18	45	12	34	9	1	125
FULL REGISTRATION	69	408	60	379	56	10	344

Table 9b. Number and Wildlife Mangement Unit of inspected and active Class III and Class IV C/P-OC facilities from which cervids have escaped, the number of escaped cervids, the number of facilities that have recovered escaped cervids, and the number of recovered cervids during the last 4 years. Also listed are the number of facilities that had marked cervids prior to escape and the number of facilities that isolated escaped cervids after recovery. Sample sizes of Class I and Class II facilities were too small for analysis by WMU.

WMU	Facilities With Escapes	Escaped Cervids	Facilities With Recoveries	Recovered Cervids	Facilities Mark Escapes	Facilities Isolated Recoveries	Inspected and Active Facilities
EUP							10
NE	8	23	7	26	6		62
NW	22	53	18	62	15	2	103
SB	11	26	11	24	8	2	67
SC	13	138	9	135	10	3	68
SE	15	97	12	76	12	3	61
SW	12	86	9	70	11	1	71
WUP	6	30	6	20	3		27

Table 10a. Number and class of inspected and active C/P-OC facilities with cervid escapes during the last 4 years showing reasons for escapes.

Facility Class	Gate Open	Low Fence	Cervid Mishandled	Other	Inspected and Active Facilities
CLASS I (HOBBY)	1	3	1	1	29
CLASS II (EXHIBITION)	1	1	0	1	8
CLASS III (RANCH)	4	6	1	7	125
FULL REGISTRATION	25	18	4	27	344

Table 10b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities with cervid escapes during the last 4 years showing reasons for escapes. Sample sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	Gate Open	Low Fence	Cervid Mishandled	Other	Inspected and Active Facilities
EUP	0	0	0	0	10
NE	5	2	0	2	62
NW	5	9	3	5	103
SB	4	5	0	2	67
SC	2	4	0	9	68
SE	6	1	0	9	61
SW	5	2	1	5	71
WUP	2	1	1	2	27

Table 11a. Number and class of inspected and active C/P-OC facilities that have released cervids or experienced other losses (such as theft) during the last 4 years.

Facility Class	Released Cervids	Other Losses	Inspected and Active Facilities
CLASS I (HOBBY)		1	29
CLASS II (EXHIBITION)			8
CLASS III (RANCH)	1	39	125
FULL REGISTRATION	3	47	344

Table 11b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that have released cervids or experienced other losses (such as theft) during the last 4 years. Samples sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	Released Cervids	Other Losses	Inspected and Active Facilities
EUP			10
NE	1	14	62
NW	1	17	103
SB	1	22	67
SC		11	68
SE		9	61
SW		6	71
WUP	1	7	27

Table 12a. Number of cervid deaths occuring on inspected and active C/P-OC facilities in each class during the last 4 years and the proportion of those deaths occuring due to harvest, illness, or other causes. Also shown are the number of cervid deaths that were tested for CWD and the number of facilities that necropsied dead cervids.

		Proportion of Deaths					
Facility Class	**Total Deaths**	**Harvest**	**Illness**	**Other**	**Tested for CWD**	**Necropsy Deaths**	**Inspected and Active Facilities**
CLASS I (HOBBY)	56	0.25	0.20	0.55	6	4	29
CLASS II (EXHIBITION)	28	0.04	0.14	0.82	3	2	8
CLASS III (RANCH)	12530	0.78	0.03	0.19	1068	36	125
FULL REGISTRATION	4997	0.49	0.11	0.40	894	79	344

Table 12b. Number of cervid deaths occuring on inspected and active Class III and Class IV C/P-OC facilities in all Wildlife Management Units during the last 4 years and the proportion of those deaths occuring due to harvest, illness, or other causes. Also shown are the number of cervid deaths that were tested for CWD and the number of facilities that necropsied dead cervids. Sample size of Class I and Class II facilities was too small for analysis at the WMU level.

		Proportion of Deaths					
WMU	**Total Deaths**	**Harvest**	**Illness**	**Other**	**Tested for CWD**	**Necropsy Deaths**	**Inspected and Active Facilities**
EUP	361	0.35	0.05	0.60	50	5	10
NE	3071	0.70	0.05	0.24	374	19	62
NW	6341	0.71	0.05	0.23	404	33	103
SB	2926	0.77	0.05	0.18	209	22	67
SC	1726	0.72	0.06	0.22	358	11	68
SE	1216	0.66	0.08	0.26	266	11	61
SW	1088	0.49	0.05	0.46	202	8	71
WUP	798	0.78	0.02	0.20	99	6	27

Table 13a. Number and class of inspected and active C/P-OC facilities that disposed of cervid carcasses above ground, through rendering, through burying, or through another method.

Facility Class	Above Ground	Rendered	Buried < 3ft	Buried > 3ft	Other	Inspected and Active Facitilies
CLASS I (HOBBY)	1	0	6	13	2	29
CLASS II (EXHIBITION)	1	0	1	3	2	8
CLASS III (RANCH)	30	6	27	62	21	125
FULL REGISTRATION	28	6	71	201	50	344

Table 13b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that disposed of cervid carcasses above ground, through rendering, through burying, or through another method. Sample sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	Above Ground	Rendered	Buried < 3ft	Buried > 3ft	Other	Inspected and Active Facilities
EUP	3	0	3	1	4	10
NE	15	1	18	29	10	62
NW	10	4	21	65	10	103
SB	7	0	19	38	8	67
SC	3	2	13	41	9	68
SE	4	3	7	40	11	61
SW	6	2	13	40	14	71
WUP	10	0	4	9	5	27

Table 14a. Number and class of inspected and active C/P-OC facilities that disposed of cervid carcasses within enclosures, outside enclosures, in landfills, and off-site during the last 4 years.

Facility_Class	Within Enclosure	Outside Enclosure	Landfill	Off-Site	Inspected and Active Facilities
CLASS I (HOBBY)	3	19	0	0	29
CLASS II (EXHIBITION)	1	3	0	4	8
CLASS III (RANCH)	86	31	10	3	125
FULL REGISTRATION	97	205	14	25	344

Table 14b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that disposed of cervid carcasses within enclosures, outside enclosures, at landfills, or off-site during the last 4 years. Samples sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	Within Enclosure	Outside Enclosure	Landfill	Off-Site	Inspected and Active Facilities
EUP	2	5	0	1	10
NE	33	22	4	2	62
NW	49	55	3	2	103
SB	25	37	4	6	67
SC	22	36	1	3	68
SE	17	36	5	2	61
SW	25	32	5	9	71
WUP	10	13	2	3	27

Table 15a. Number and class of inspected and active C/P-OC facilities that sell velvet antlers, buy and sell cervid semen, buy and sell cervid urine, and buy and sell cervid scent.

Facility Class	Velvet Antlers	Semen		Urine		Scent		Inspected and Active Facilities
	Sell	Buy	Sell	Buy	Sell	Buy	Sell	
CLASS I (HOBBY)		0	0	0	0	0	0	29
CLASS II (EXHIBITION)		0	0	1	1	1	1	8
CLASS III (RANCH)	1	7	2	0	1	0	1	125
FULL REGISTRATION	21	45	13	1	7	0	5	344

Table 15b. Number and Wildife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that sell velvet antlers, buy and sell cervid semen, buy and sell cervid urine, and buy and sell cervid scent. Samples sizes of Class I and Class II facilities were too small for analysis by WMU.

WMU	Velvet Antlers	Semen		Urine		Scent		Inspected and Active Facilities
	Sell	Buy	Sell	Buy	Sell	Buy	Sell	
EUP		2	0	0	0	0	0	10
NE	2	7	2	0	0	0	0	62
NW	6	12	4	0	0	0	0	103
SB	6	8	3	0	0	0	0	67
SC	1	6	1	1	1	0	0	68
SE	4	8	3	0	1	0	1	61
SW		9	2	0	6	0	5	71
WUP	3	0	0	0	0	0	0	27

Table 16a. Number and class of inspected and active C/P-OC facilities that purchased cervids from out-of-state during the last 3 years, including the number of cervids purchased, the number of facilities that had Veterinary Inspection Certificates and TB tests for all cervids purchased from out-of-state. Also listed are the number of facilities for which employees picked up cervids purchased from out-of-state and the number that used brokers to arrange out-of-state purchases.

Facility Class	Purchased Cervids	Number Purchased	Cervids had Vet Inspection Certificate	TB Tested Cervids	Picked Up Cervids	Used Broker	Inspected and Active Facilities
CLASS I (HOBBY)	1	1		1			29
CLASS II (EXHIBITION)	1	2	1	1	1		8
CLASS III (RANCH)	13	540	12	11	3	2	125
FULL REGISTRATION	45	190	39	36	32	5	344

Table 16b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that purchased cervids from out-of-state during the last 3 years, including the number of cervids purchased and the number of facilities that had Veterinary Inspection Certificates and TB tests for all cervids purchased from out-of-state. Also listed are the number of facilities for which employees picked up cervids purchased out-of-state and the number that used brokers to arrange out-of state purchases. Samples sizes of Class I and Class II facilities were too small for analysis by WMU.

WMU	Purchased Cervids	Number Purchased	Cervids had Vet Inspection Certificate	TB Tested Cervids	Picked Up Cervids	Used Broker	Inspected and Active Facilities
EUP	1	94	1	1		1	10
NE	9	70	8	7	3	1	62
NW	14	293	14	13	11	1	103
SB	5	54	5	5	4	1	67
SC	8	38	5	5	4	2	68
SE	8	25	7	7	4		61
SW	5	45	5	4	4	1	71
WUP	8	111	6	5	5		27

Table 17a. Number and class of inspected and active C/P-OC facilities that shipped cervids out-of-state during the last 3 years, including the number of cervids shipped and the number of facilities that had Veterinary Inspection Certificates and TB tests for all cervids shipped out-of-state. Also listed are the number of facilities for which employees transported cervids out-of-state and the number of facilities that shipped meat out-of-state.

Facility Class	Shipped Cervids	Number Shipped	Cervids had Vet Inspection Certificate	TB Tested Cervids	Transported Cervids	Shipped Meat	Inspected and Active Facilities
CLASS I (HOBBY)		0					29
CLASS II (EXHIBITION)		0					8
CLASS III (RANCH)		0				16	125
FULL REGISTRATION	20	261	17	18	8	11	344

Table 17b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that shipped cervids out-of-state during the last 3 years, including the number of cervids shipped and the number of facilities that had Veterinary Inspection Certificates and TB tests for all cervids shipped out-of-state. Also listed are the number of facilities for which employees transported cervids out-of-state and the number of facilities that shipped meat out-of-state. Samples sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	ShippedCervids	Number Shipped	Cervids had Vet Inspection Certificate	TB Tested Cervids	Transported Cervids	Shipped Meat	Inspected and Active Facilities
EUP		0					10
NE	1	1	1	1	1	4	62
NW	3	23	2	3	2	9	103
SB	3	103	3	3	2	7	67
SC	3	13	2	2		2	68
SE	7	91	6	6	1		61
SW	3	30	3	3	2		71
WUP		0				5	27

Table 18a. Number and class of inspected and active C/P-OC facilities that shipped cervids within Michigan in the last 3 years, including the number of cervids shipped and the number of facilities that had Veterinary Inspection Certificates and TB tests for all cervids shipped within Michigan. Also listed are the number of facilities for which employees transported cervids within Michigan and the number that shipped meat within Michigan.

Facility Class	Shipped Cervids	Number Shipped	Cervids had Vet Inspection Certificate	TB Tested Cervids	Transported Cervids	Shipped Meat	Inspected and Active Facilities
CLASS I (HOBBY)	3	10	1	3	3		29
CLASS II (EXHIBITION)	4	12		1	2		8
CLASS III (RANCH)	6	82	5	13	8	27	125
FULL REGISTRATION	203	4359	65	174	127	48	344

Table 18b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities that shipped cervids within Michigan in the last 3 years, including the number of cervids shipped and the number of facilities that had Veterinary Inspection Certificates and TB tests for all cervids shipped within Michigan. Also listed are the number of facilities for which employees transported cervids within Michigan and the number that shipped meat within Michigan. Sample sizes of Class I and Class II facilites were too small for analysis at the WMU level.

WMU	Shipped Cervids	Number Shipped	Cervids had Vet Inspection Certificates	TB Tested Cervids	Transported Cervids	Shipped Meat	Inspected and Active Facilities
EUP	4	74	2	3			10
NE	19	409	8	17	12	11	62
NW	45	1044	17	40	34	20	103
SB	31	575	9	26	21	23	67
SC	26	493	11	31	21	9	68
SE	32	720	10	29	15	3	61
SW	44	965	12	35	27	5	71
WUP	8	183	1	6	5	4	27

Table 19a. Number and class of inspected and active C/P-OC facilities where cervids from another facility were temporarily housed, where males and females were transferred into or out of the facility for breeding, and where cervids were artificially inseminated over the past 3 years.

Facility Class	Cervids Housed Temporarily	Transferred Males	Transferred Females	Artificially Inseminated Cervids	Inspected and Active Facilities
CLASS I (HOBBY)	1	1	2		29
CLASS II (EXHIBITION)	1	1			8
CLASS III (RANCH)	2	2	3	1	125
FULL REGISTRATION	39	37	26	43	344

Table 19b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities where cervids from another facility were temporarily housed, where males and females were transferred into or out of the facility for breeding, and where cervids were artificially inseminated over the past 3 years. Sample sizes for Class I and Class II facilities were too small for analysis at the WMU level.

WMU	Cervids Housed Temporarily	Transferred Males	Transferred Females	Artificially Inseminated Cervids	Inspected and Active Facilities
EUP	1				10
NE	6	4	5	4	62
NW	4	8	4	13	103
SB	4	7	4	7	67
SC	5	3	2	3	68
SE	6	6	2	8	61
SW	11	9	11	9	71
WUP	4	2	1		27

Table 20a. Number and class of inspected and active C/P-OC facilities with 1 to > 10 pens for housing cervids on-site at the time of inspection.

Facility Class	1 Pen	2-3 Pens	4-5 Pens	6-10 Pens	> 10 Pens	Inspected and Active Facilities
CLASS I (HOBBY)	17	9	3	0	0	29
CLASS II (EXHIBITION)	4	2	2	0	0	8
CLASS III (RANCH)	66	35	11	9	1	125
FULL REGISTRATION	117	94	71	46	11	344

Table 20b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities with 1 to > 10 pens for housing cervids on-site at the time of inspection. Sample sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	1 Pen	2-3 Pens	4-5 Pens	6-10 Pens	> 10 Pens	Inspected and Active Facilities
EUP	2	5	3	0	0	10
NE	31	14	8	5	2	62
NW	32	32	18	15	2	103
SB	32	15	9	10	0	67
SC	21	16	17	9	4	68
SE	41	13	3	1	3	61
SW	11	28	18	13	1	71
WUP	13	6	6	2	0	27

Table 21a. Number and class of inspected and active C/P-OC facilities where woven wire, chain link, wood, and other materials were used to construct fences.

Facility Class	Woven Wire	Chain Link	Wood	Other	Inspected and Active Facilities
CLASS I (HOBBY)	25	11	4	5	29
CLASS II (EXHIBITION)	6	1	1	2	8
CLASS III (RANCH)	116	30	2	20	125
FULL REGISTRATION	321	73	16	58	344

Table 21b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities where woven wire, chain link, wood, and other materials were used to construct fences. Sample sizes of Class I and Class II facilities were too small for analysis by WMU.

WMU	Woven Wire	Chain Link	Wood	Other	Inspected and Active Facilities
EUP	9	2	1	4	10
NE	57	18	4	10	62
NW	99	16	5	3	103
SB	62	12	0	26	67
SC	66	17	3	5	68
SE	53	18	4	13	61
SW	68	14	1	11	71
WUP	23	6	0	6	27

Table 22a. Number and class of inspected and active C/P-OC facilities where perimeter fences were inspected monthly, where free-ranging cervids had been within the facility, and where minimum fence height was too low for the species housed at the facility.

Facility Class	Fence Inspected Monthly	Free Ranging Cervids Inside	Fences Too Low	Inspected and Active Facilities
CLASS I (HOBBY)	29		12	29
CLASS II (EXHIBITION)	6	1	1	8
CLASS III (RANCH)	123	25	62	125
FULL REGISTRATION	335	13	160	344

Table 22b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities where perimeter fences were inspected monthly, where free-ranging cervids had been within the facility, and where minimum fence height was too low for the species housed at the facility. Sample sizes of Class I and Class II facilities were too small for analysis at the WMU level.

WMU	Fence Inspected Monthly	Free Ranging Cervids Inside	Fences Too Low	Inspected and Active Facilities
EUP	10	1	4	10
NE	61	13	36	62
NW	98	9	45	103
SB	66	5	49	67
SC	68	5	28	68
SE	60	2	26	61
SW	69	3	29	71
WUP	26		5	27

Table 23a. Number and class of inspected and active C/P-OC facilities where records were stored in either electronic or paper format, where facility owners were asked to alter records, and where owners altered records.

Facility Class	Record Storage		Asked to Alter Records	Altered Records	Inspected and Active Facilities
	Electronic	Paper			
CLASS I (HOBBY)	1	28			29
CLASS II (EXHIBITION)	1	8			8
CLASS III (RANCH)	22	125	2		125
FULL REGISTRATION	63	343	2	2	344

Table 23b. Number and Wildlife Management Unit of inspected and active Class III and Class IV C/P-OC facilities where records were stored in either electronic or paper format, where facility owners were asked to alter records, and where owners altered records. Sample sizes for Class I and Class II facilities were too small for analysis at the WMU level.

	Record Storage				
WMU	**Electronic**	**Paper**	**Asked to Alter Records**	**Altered Records**	**Inspected and Active Facilities**
EUP	2	10			10
NE	11	62			62
NW	26	103	1	1	103
SB	12	67	2		67
SC	11	68	1		68
SE	7	60		1	61
SW	10	71			71
WUP	6	27			27

Appendix C
Maps

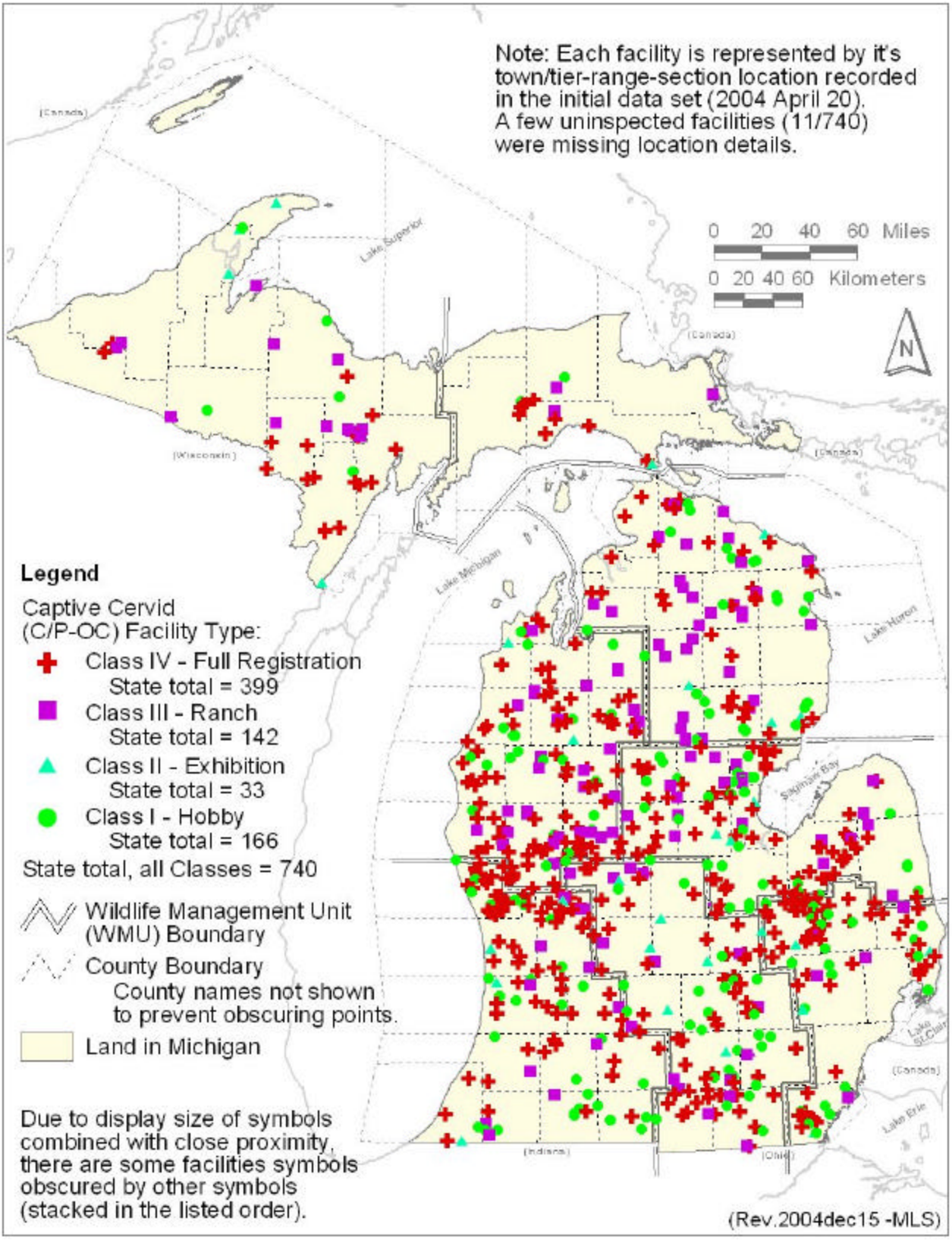

Figure 1: Locations of Captive/Privately-Owned Cervid (C/P-OC) Facilities with registration numbers.

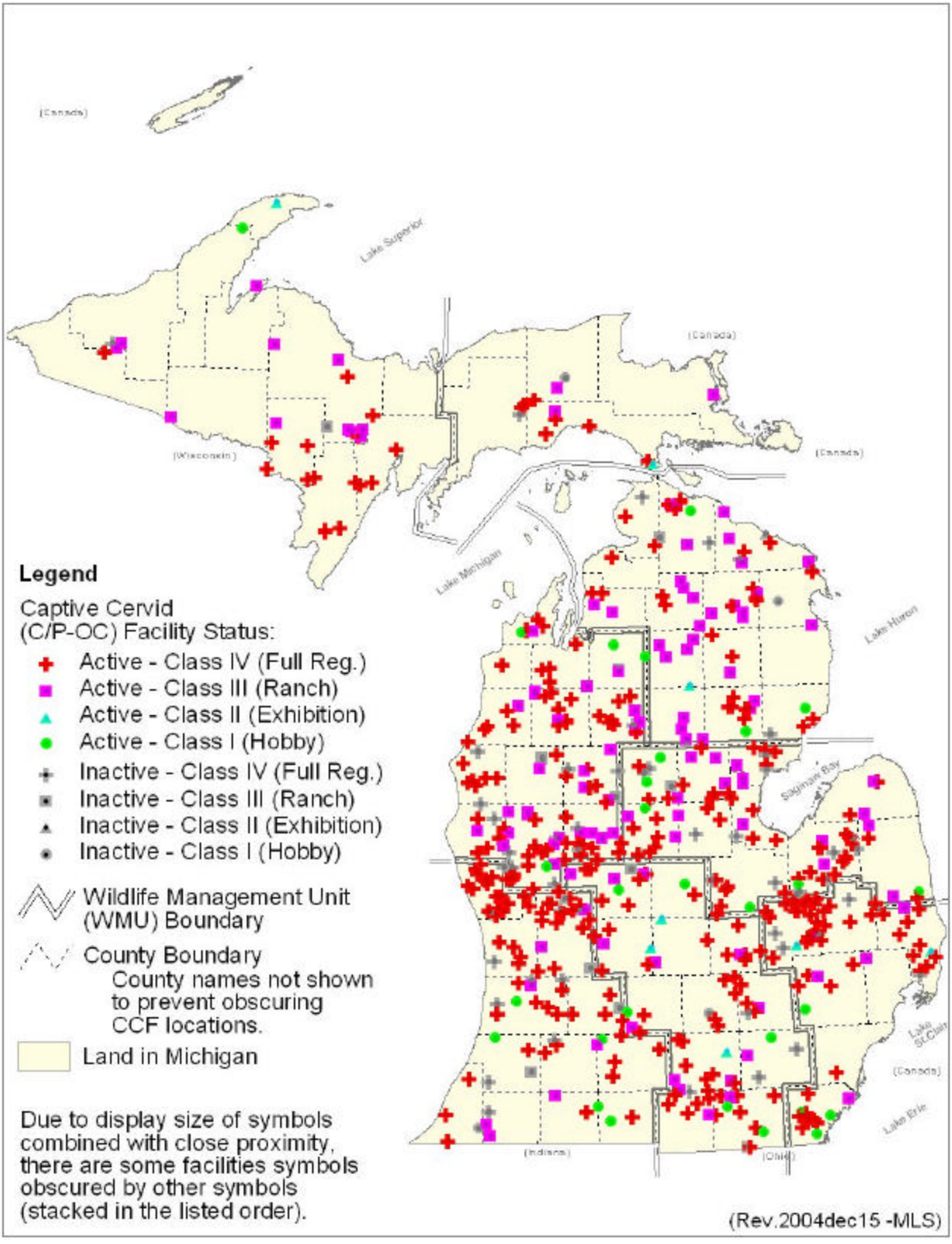

Figure 2. Locations of inspected Captive/Privately-Owned Cervid (C/P-OC) Facilities identified by active/inactive status.

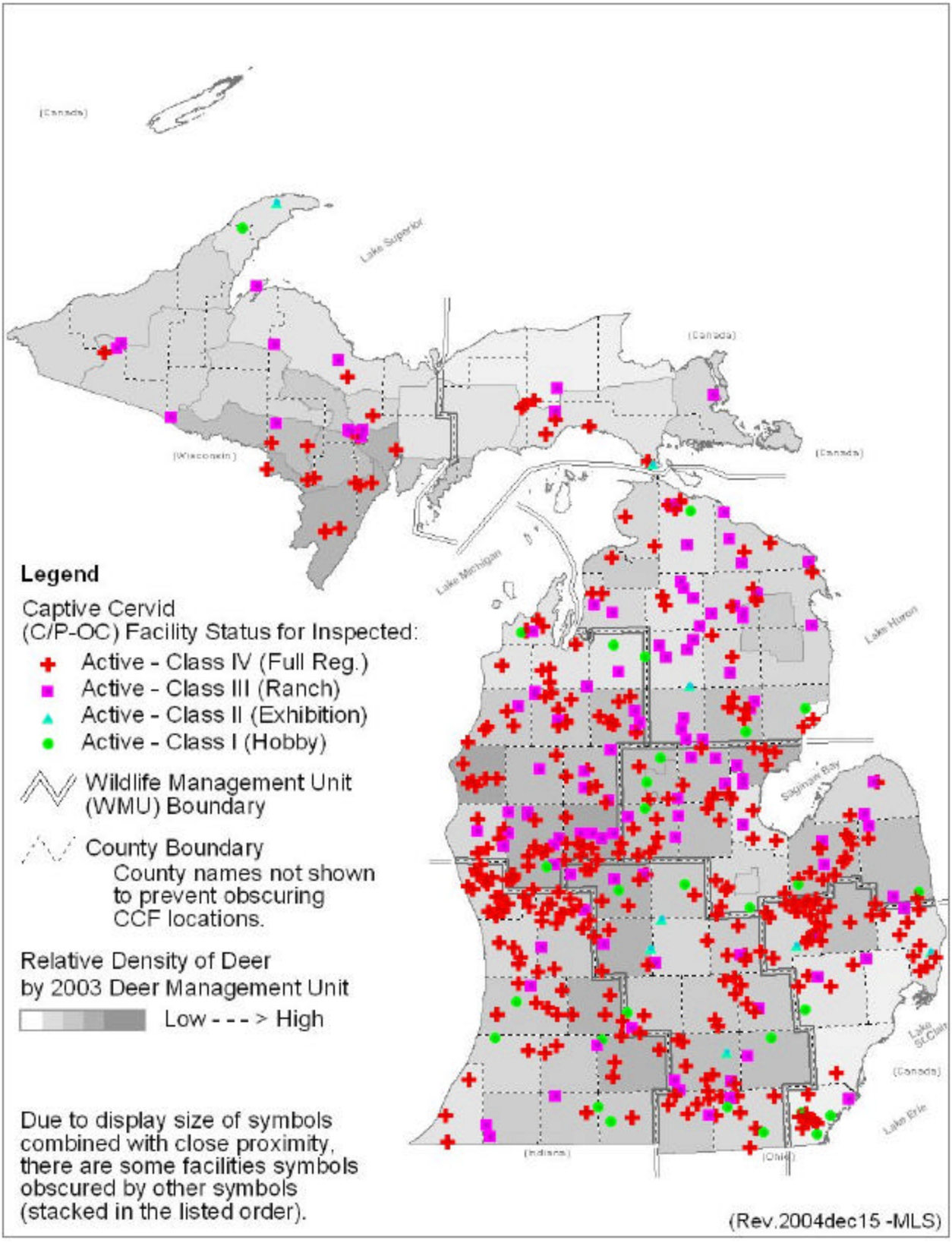

Figure 3: Free-ranging deer density, based on 2003 deer management unit estimates, with locations of the active and inspected Captive/Privately-Owned Cervid (C/P-OC) Facilities.

Appendix D
Risk Factor Ranking Protocol for Prioritizing Facility Inspection

D.1. *Facility inspection priority ranking*. The Risk Factors and Inspection Priority Committee used available MDA and MDNR data to derive crude but biologically-plausible risk factors for the importation/propagation of CWD via C/P-OC. These were then to be used to prioritize inspection of facilities, so that those with the greatest theoretical risk could be inspected first. These risk factors were largely driven by the existence and quality of the available data. The prioritization of risk was only as accurate as the data from which it was derived, and was intended only as a tool to organize inspections, not as an objective measure of real risk. Moreover, they were understood not to be a comprehensive list of the risk factors for CWD introduction and propagation, or mutually exclusive.

The committee determined risk factors, ranked each factor for importance to CWD introduction, and assigned each factor a subjective weight based on the perceived influence of the factor, as follows:

Table D.1. Risk factors for prioritization of Michigan C/P-OC facility inspections, 2004.

Risk factor	Rank of importance	Significance weight
MDA facility class	1	15
Susceptible species present	2	15
Gap between reported mortalities and number tested for CWD	3	15
History of escapes	4	10
History of quarantine(s)	5	9.5
Biosecurity	6	9
History of MDA investigations	7	8.5
Herd inventory not current	8	8
Frequency of animal movement	9	6.5
Quality of movement records	10	6
Carcass disposal	11	4
Stocking density	12	3.5
Free-ranging deer density in surrounding area	13	2
Agreement between MDA & MDNR registration records	14	1

MDA and MDNR data were then used to rate each facility for each risk factor. A score of 1 indicated lowest risk, 2 was intermediate risk, and 3 was highest risk. The rating was multiplied by the significance weight to produce an overall inspection priority ranking:

(RF1 score * 15) + (RF2 * 15) + (RF3 * 15) + ... + (RF14 * 10)= Overall priority ranking

Highest scores were considered the highest priority for inspection.

D.2. *Description of the risk factors.*

- MDA facility class: In its Operational Standards (OSRPOCF 2000) MDA defined 4 classes of C/P-OC facilities: Hobby (Class I), Exhibition (Class II), Ranch (Class III) and Full registration (Class IV). Different regulations and animal movement requirements apply to each. Consequently, the committee judged each class to have different potential risk levels. Class III and IV facilities were considered to be higher risk due to the number of live animal movements associated with them. These facilities received a rank of 3, Class I facilities received a 2 and Class II facilities received a 1.
- Susceptible species: As of May 2004, WTD, mule deer, and elk, were known to be susceptible to CWD (Williams and Miller 2002; Williams et al. 2002). Because of their genetic similarity to these species, red deer and mule deer-WTD hybrids were assumed to be susceptible. Facilities with

susceptible species received a 3; those without susceptible species were given a 1. Facilities not listing species held on inventory received a 2.

- CWD testing gap: Some facilities remove (through culling, harvest, and mortality) animals regularly, and consequently have more opportunities to collect tissue samples for CWD testing. Facilities that reported eligible removals on inventories yet had no CWD test results on record received a 3; those with eligible removals testing <30% of those removed received a 2. Facilities testing >30% of eligible removals and those that did not remove animals received a 1.
- History of escapes: Facilities with evidence of C/P-OC escapes in MDNR or MDA records where the escape was not reported to MDA by the facility received a rank of 3. Facilities experiencing escapes but that reported them to MDA received a 2. Those with no evidence of escapes received a 1.
- History of quarantines: Facilities were quarantined by MDA due to a variety of non-compliance issues. Facilities that were or had been quarantined received a 2; those with no record of quarantine received a 1.
- Biosecurity: Committee members reviewed MDA facility records for evidence of factors indicative of compromised biosecurity, primarily fence and gate faults. Facilities where fence and gate faults were noted on previous MDA inspections received a ranking of 3, as did facilities with no record of having been inspected. Where previous MDA inspection comments noted good fences and gates or made no negative comments, the facilities received a 2.
- History of MDA investigation: Facilities that had been investigated for a non-compliance issue were given a 2; those not on the MDA investigations data base were given a 1.
- Herd inventory not current: Each January, C/P-OC facilities are required to submit a complete year-end herd inventory to MDA. If a current inventory for 2004 was on file, the facility was given a ranking of 1. If the inventory for 2003 was on file but 2004 was missing, the facility received a 2. If the most recent inventory on file with MDA was more than two years old or no inventory was ever submitted, the facility received a 3.
- Frequency of animal movement: Based on MDA facility records, facilities that had an inventory on file which documented purchases/sales of animals but had no specific movement records received a 3, as did facilities that bought or sold >10 animals per year, or had purchased animals from a CWD positive state. Facilities that purchased animals from a state where CWD is not currently known to occur were given a 2. Facilities where fewer than 10 animals were bought/sold per year, facilities that only moved animals intrastate, and facilities with =10 movements over the last 4 years received a 1.
- Movement record quality: The quality of C/P-OC movement records varied greatly. If the herd inventory suggested substantial movement, but no specific movement records were on file, the facility received a 3. If no specific movement data were available, the facility was Class III or IV, and the herd inventory was not current, the facility received a 3 as well. If the facility showed evidence of movements but did not record animal ID, TB status, etc., it was given a 3. Facilities with movement records that showed TB status, animal ID, and origin/destination were given a 2. Facilities with evidence of minimal movement were given a 1.
- Carcass disposal: Although the MDA Operational Standards stipulate that records must contain "the method and site of disposal" for all C/P-OC deaths (OSRPOCF 2000, p. 2), after reviewing the available data, the committee agreed that sufficient information for ranking facilities on this factor did not exist. Consequently, all facilities were issued a 1. The factor was retained in the model to emphasize that evidence of its importance has been demonstrated (Miller et al. 2004), in spite of the current lack of data..
- Stocking density: Similarly, stocking density is a proven risk factor for propagation of CWD (Williams and Miller 2002; Williams et al. 2002), yet little or no data were available to use in rankings, so all facilities received a 1.
- Free-ranging deer density: MDNR data were used to estimate relative densities of free-ranging deer in the county where each C/P-O facility was located. Risk of propagation of contagious diseases such as CWD is often related to the density of susceptible animals. Facilities where deer density in the

surrounding county was high (≥40 deer per mile^2) received a ranking of 3, facilities where density was moderate (20–39 deer per mile^2) received a 2, and those where density was low (<20 deer per mile^2) received a 1.

- MDA/MDNR registration agreement: MDNR had most regulatory authority over C/P-OC prior to enactment of POCPMA in 2000. In April 1998, MDNR re-visited fencing requirements and the approved height for deer was changed to 10 feet of woven wire. Facilities in existence in 2000 that had only 8 foot fences (as was previously acceptable), were allowed to add 1 high-tensile wire above the 8 foot woven wire fence to come into compliance with the new standard. Facilities that were grandfathered in had less stringent fence requirements, and so were given a rank of 2. Newer facilities with 10 foot woven wire fences were given a 1.